Railway Mechanical Engineer

FOUNDED IN 1832

INDEX TO VOLUME CV

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* Illustrated article; § editorial; † short, non-illustrated article or note; ‡ communication.

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PERSONAL MENTION

OBITUARIES

SUPPLY TRADE NOTES

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OBITUARIES

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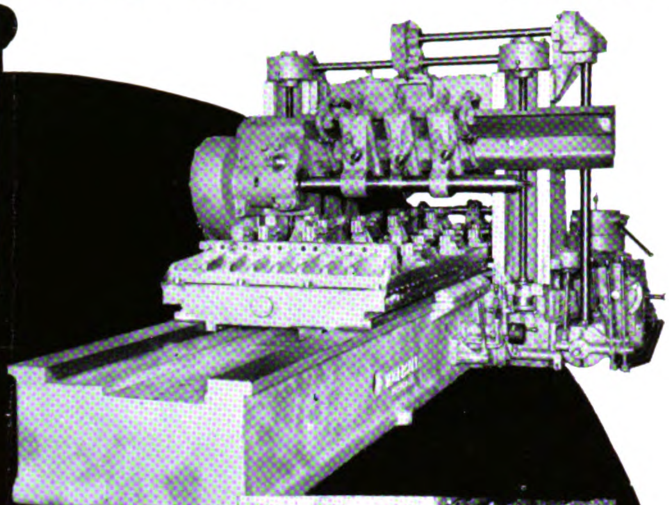
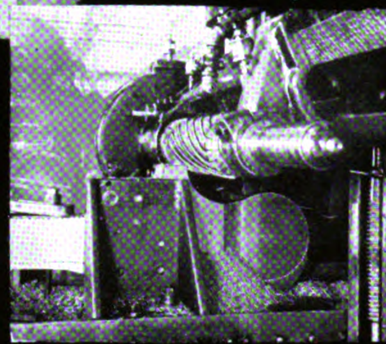
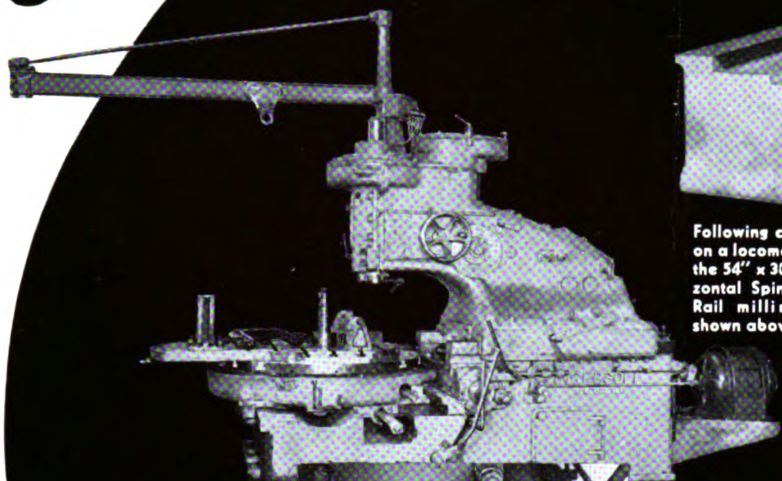
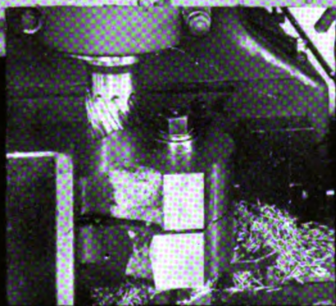
SAVING MONEY ON RAILROAD WORK....



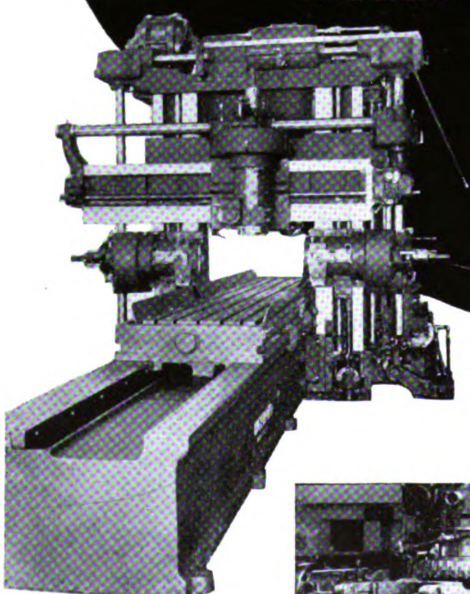


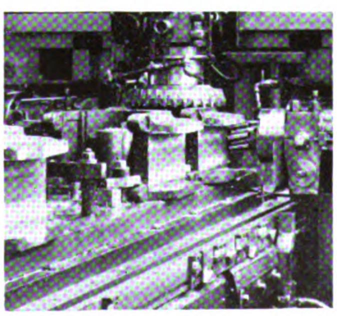
Following contour marks on a locomotive rod with the 54" x 30" x 16' Horizontal Spindle Inclined Rail milling machine shown above.





Milling the radius on a pair of rods with an Ingersoll Adjustable Rotary milling machine using a 5" x 12" Ingersoll helical cutter.





The rolls and inner face of new driving boxes are being milled on this 36" x 36" x 16', 3-head Ingersoll Adjustable Rail milling machine.

These three Ingersolls are saving money for railroad shops throughout the country. Each of these tools is easily controlled, all elements have power feed and rapid traverse and each has the built-in reserve strength needed to maintain maximum output throughout a long productive life.

The Inclined Rail milling machine, in sizes to suit the customer's work, is used extensively for slabbing, channeling and edging locomotive rods and milling shoes, wedges and link motion parts. It is powerful and rugged enough to drive slabbing and channeling cutters to capacity without distress. Equipped with Ingersoll universal rod fixtures two large rods are held for slabbing or channeling and six for edging.

The Adjustable Rotary milling machine returns substantial dividends on such work as rod ending, milling out jaws, trepanning and contour milling. Here again Ingersoll cutters and fixtures increase the efficiency of machine and operator.

The Adjustable Rail machine is well adapted to milling driving boxes. One face, both edges and both shoe and wedge fits, including the tapers, are milled in one setting.

Send for interesting data about these machines and their use.

THE INGERSOLL MILLING MACHINE COMPANY » » ROCKFORD, ILLINOIS, U. S. A.

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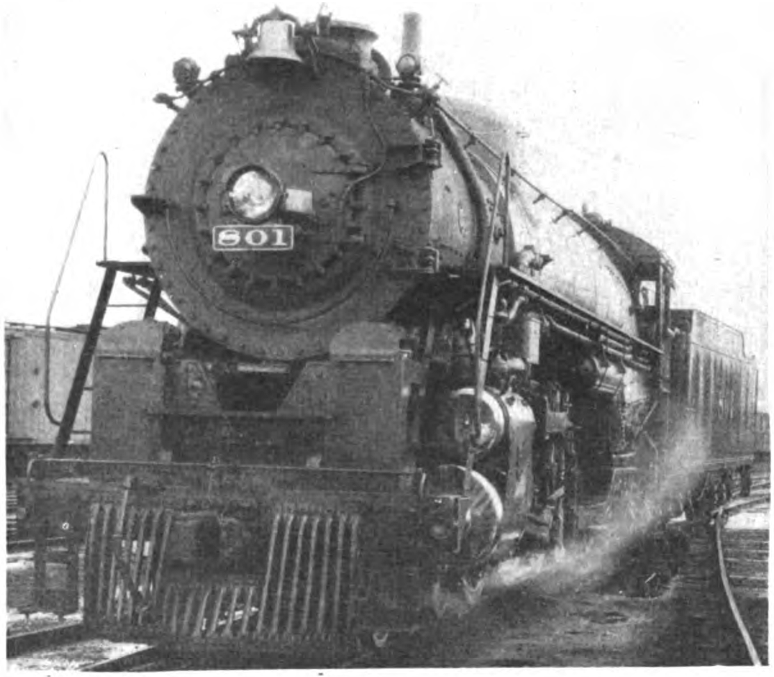


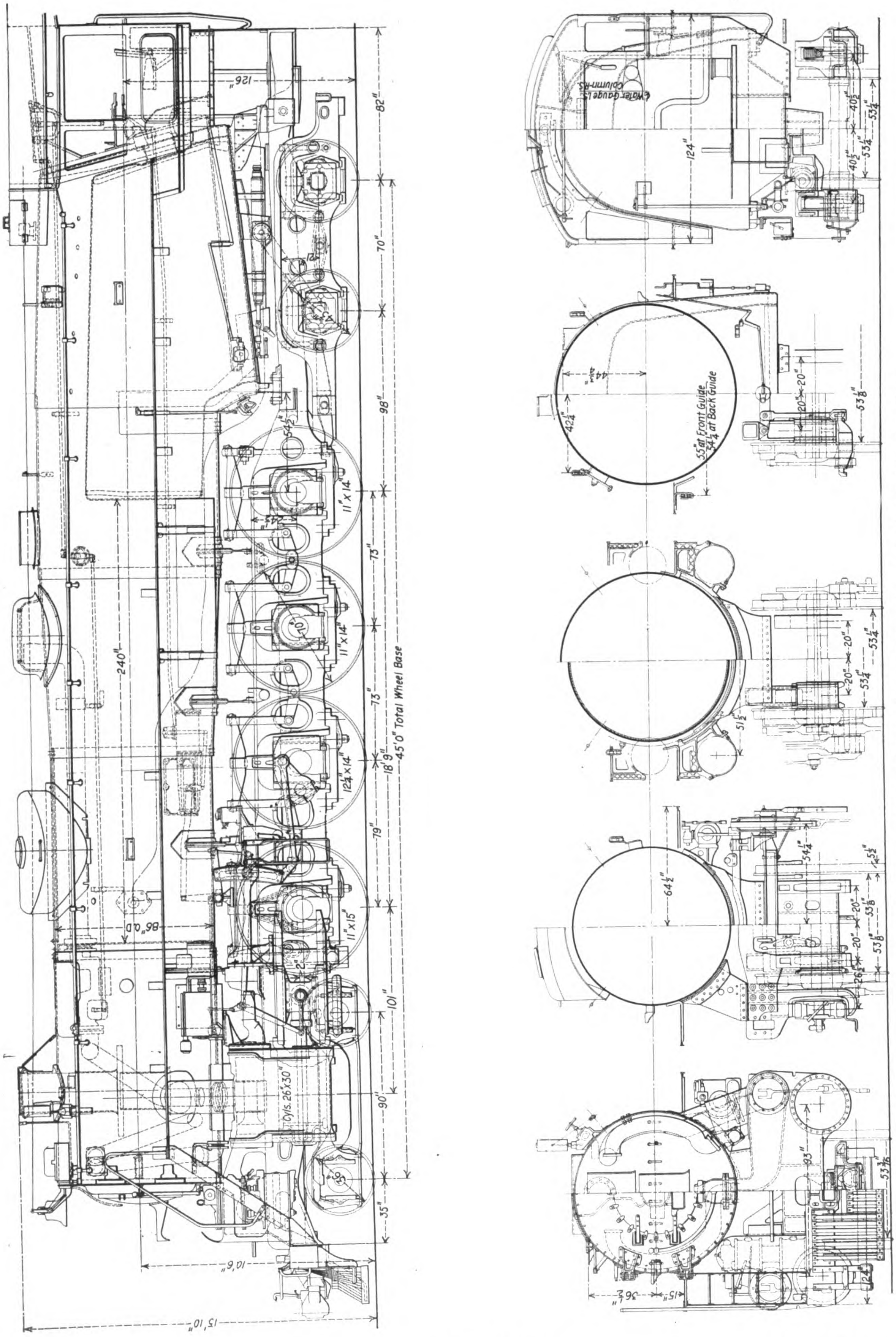
One of the new Cotton Belt 4-8-4 type locomotives just in from a run

Cotton Belt Buys Modern Freight Power

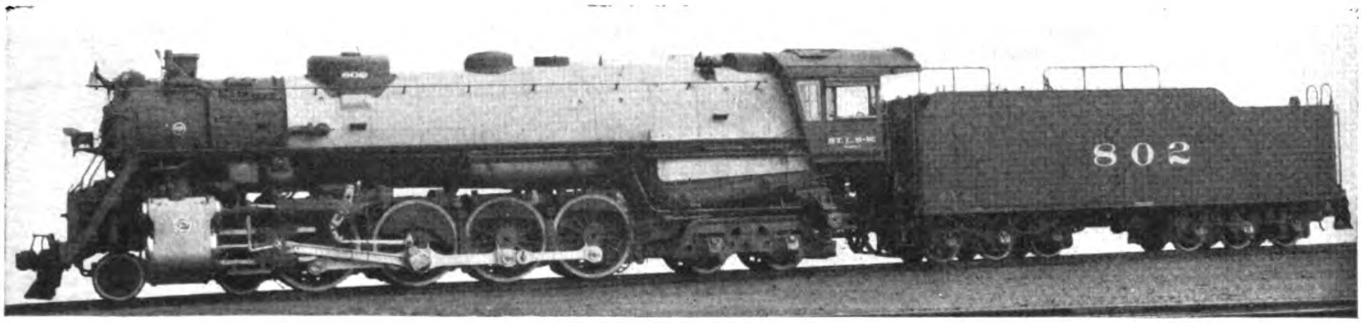
Design of 4-8-4 type has pleasing lines and promises notable performance from capacity and fuel economy standpoints

DURING the month of September, the St. Louis Southwestern placed in service a series of ten Baldwin-built, 4-8-4 type, oil-burning, steam locomotives to replace 2-8-0 type locomotives in handling the fast merchandise and perishable freight trains which comprise such a large proportion of Cotton Belt business. The new locomotives, known as the Class L-1, are used largely in main line movements between Pine Bluff, Ark., and Tyler, Tex. With a normal rated tractive force only 18 per cent greater than that of the Class K-1 locomotives replaced, they are handling approximately 30 per cent more tonnage at higher speeds.

This is expected to result in a reduction of about 20 per cent in train mileage. The new locomotives were designed with a tractive force of 61,500 lb., as great as could be had with a ratio of adhesion close to 4, considering the loading permissible on existing bridges



Elevation and cross-sectional views of the Cotton Belt 4-8-4 locomotives



Cotton Belt freight locomotive built by Baldwin

and other roadway structures. (Two steel bridges were replaced with new and heavier structures so as not to limit unduly this feature of the design.) As a portion of the territory over which the locomotives are operated is of undulating character with ruling grades of 1.2 per cent, 7,000 ft. long, it was necessary to provide large boiler capacity in order to negotiate these grades at the minimum desired speed of 15 m. p. h. The use of a four-wheel trailing truck was decided on in order to carry the greater part of the increased boiler weight. In order to provide for operation over track having a maximum curvature of 16 deg., the Alco lateral motion device was used on the front pair of driving wheels, thus keeping the length of the rigid wheel base within necessary limits. This curvature requirement also crowded together the rear longitudinal members of the General Steel Castings Corporation's integral frame and cylinder casting, in order to provide room for the lateral swing of the trailer truck, and the close spacing of these members in turn necessitated an innovation in design of the combustion air intakes, part of the air being taken at the rear of the cast steel fire pan at right angles to the path of the oil spray and part being taken at the front of the pan, parallel with the oil spray, both air intakes being controlled by suitable dampers operated from the cab. It was also necessary to limit the total wheel base of locomotive and tender as it was not desired to replace existing 90-ft. turntables.

Table Showing the Principal Weights, Dimensions and Proportions of the St. Louis Southwestern 4-8-4 Type Locomotives

Railroad	St. Louis Southwestern
Builder	Baldwin Loocomotive Works
Type	4-8-4
Service	Freight
Cylinders, diameter and stroke	26 in. by 30 in.
Valve gear, type	Walschaert
Valves, piston type, diameter	14 in.
Maximum travel	7¾ in.
Weights in working order:	
On drivers	242,500 lb.
On front truck	82,000 lb.
On trailing truck	98,000 lb.
Total engine	422,500 lb.
Total tender	307,000 lb.
Total engine and tender	729,500 lb.
Wheel bases:	
Driving	18 ft. 9 in.
Rigid	12 ft. 2 in.
Total engine	45 ft. 0 in.
Total engine and tender	87 ft. 7 in.
Wheels, diameter outside tires:	
Driving	70 in.
Front truck	36 in.
Trailing truck	43 in.
Journals, diameter and length:	
Driving, main	12½ in. by 14 in.
Driving, front	11 in. by 15 in.
Driving, others	11 in. by 14 in.
Engine truck	Roller bearing
Trailing truck	9 in. by 14 in.
Boiler:	
Type	Conical
Steam pressure	250 lb.
Fuel, kind	Oil
Diameter, first ring, outside	86 in.
Firebox, length and width	132⅛ in. by 96¼ in.
Combustion chamber, length	54 in.
Tubes, number and diameter	52—2¼ in.
Flues, number and diameter	200—3½ in.
Length over tube sheets	20 ft.
Grate area	88.3 sq. ft.
Heating surfaces:	
Firebox	258 sq. ft.
Combustion chamber	104 sq. ft.
Thermic syphon	107 sq. ft.
Tubes and flues	4,259 sq. ft.
Total evaporative	4,728 sq. ft.
Superheating	2,060 sq. ft.
Combined evap. and superheating	6,788 sq. ft.
Tender:	
Style	Water-bottom, riveted and welded
Water capacity	15,000 gal.
Oil capacity	5,000 gal.
Rated maximum tractive force	61,500 lb.
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent	57.3
Weight on drivers ÷ tractive force	3.94
Total weight engine ÷ combined heating surface	62.2
Boiler proportions:	
Tractive force × diameter drivers ÷ comb. heat. surface	634
Comb. firebox heat. surface ÷ grate area	5.31
Comb. firebox heat. surface, per cent of evap. heat. surface	9.92
Superheating surface, per cent of evap. heat. surface	43.6
Tractive force ÷ comb. heat. surface	9.07

Silico-Manganese Steel Used in Boiler

Silico-manganese steel, having a minimum ultimate strength of 70,000 lb. per sq. in., was furnished by the Lukens Steel Company for the boiler shell and outside firebox wrapper sheets, thus permitting the use of thinner sheets and a corresponding increase in size of boiler without exceeding the weight limitations. This steel compares with carbon steel of 55,000 lb. per sq.

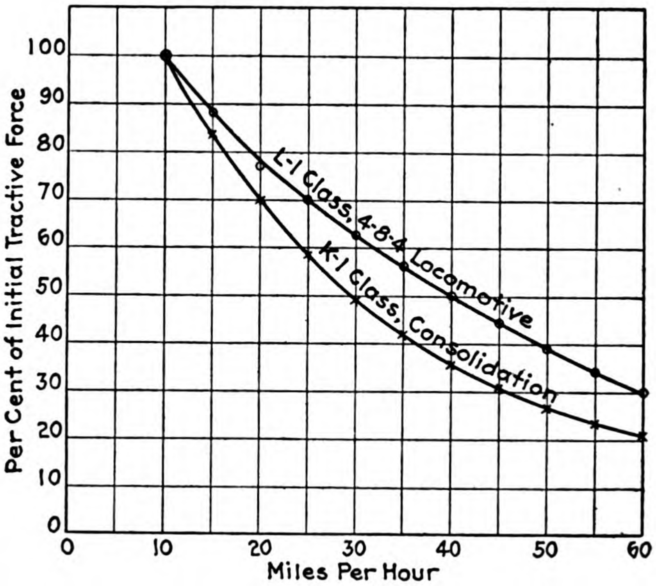


Chart showing marked superiority of the new L-1 locomotives in per cent of initial tractive force developed at speeds, owing to the provision of ample boiler capacity

in. ultimate strength, as commonly used. Boiler staying and bracing were designed so that the maximum stress on all firebox stays did not exceed 6,550 and on braces 8,000 lb. per sq. in. The boiler was built for a working pressure of 250 lb. per sq. in., this pressure being decided on as being the middle ground between lower, less efficient pressures and somewhat more efficient higher pressures, with the possibility of the increased efficiency being offset by increased boiler maintenance. The use of 250 lb. steam pressure instead of 200 lb. used on K-1 class improves the economy and gives a smarter locomotive with better acceleration.

The boiler is equipped with a Type E superheater which, it is estimated, permitted the following increases over what would have been possible with a Type A superheater: Tube and flue heating surface, 6 per cent; total evaporating heating surface 14.5 per cent, and sustained boiler horsepower, 27.1 per cent. Because of favorable tests previously conducted by the St. Louis Southwestern on Class K-1 locomotives, the L-1 class was also equipped with a feedwater heater and Thermic syphons. The Worthington Type S heater was used, although the tests were conducted on the older Type BL heater and indicated that approximately 15 per cent of the water used was recovered, with a fuel saving of 6 to 15 per cent, depending on the load factor and the operating conditions. Three Nicholson thermic syphons were applied, two in the firebox and one in the combustion chamber, as previous tests are said to have indicated fuel savings up to 13 per cent on K-1 class, equipped with only two syphons in the firebox. The use of the American front end throttle permits the delivery of the steam to the cylinders by a short route and makes superheated steam available almost at the instant the throttle is opened. With the Type E superheater covering almost the entire area of the tube sheets, it is impracticable to install a superheater damper; therefore, to maintain some circulation through the superheater, superheated steam is used for more auxiliaries than would be the case if economy only were considered. The L-1 class uses superheated steam for the air compressors, hot- and cold-water pumps, dynamo, oil-burner atomizer and blow-back, blower and whistle.

While the nominal rated tractive force of the L-1 class, 61,564 lb., is approximately 18 per cent greater than the K-1 class, it is contemplated that the L-1 class will handle approximately 30 per cent more tonnage at a higher speed and without excessive speed on the descending grades. Owing to the capacity of the boiler, the initial starting effort does not drop off so rapidly at speed, this being shown in the chart. The maximum

Special Equipment and Appliances on the St. Louis Southwestern 4-8-4 Type Locomotives

Railroad	St. Louis Southwestern
Builder	Baldwin Locomotive Works
Service	Freight
No. built	10
Firebox and boiler:	
Shell steel, silico-manganese	Lukens Steel Company
Firebox steel, open-hearth carbon	Lukens Steel Company
Back-pressure and steam gages	Ashton Valve Company
Blow-off cocks, narrow-clearance type	The Bird-Archer Company
Boiler checks	Edna Brass Company
Boiler brace iron	Logan Iron & Steel Co.
Feedwater heater, Type S	Worthington Pump & Machinery Corp.
Fire brick, Arch-lock type	American Arch Company
Fire-brick cement	Johns-Manville Company
Flexible joints for air connections to power reverse gear, main reservoir, brake cylinders, etc., and for steam connections to headlight dynamo	Barco Manufacturing Company
Flexible staybolt iron (Alco-type bolts)	Logan Iron & Steel Co.
Gage cocks, Renu-type	Sargent Company
Injector, Hancock 8,000-gal. capacity	Consolidated Ashcroft-Hancock Co.
Jacket, 18-gage cold-rolled picked steel (Minimum copper content, .20 per cent)	American Sheet & Tin Plate Co.
Lagging	Johns-Manville Company
Oil burner, Von-Boden-Ingles type	E. S. Sullivan Company
Pipe covering	Johns-Manville Company
Pyrometer	The Superheater Company
Rivets, Victor	Champion Rivet Company
Safety valves (1 muffle; 2 open)	Consolidated Ashcroft-Hancock Co.
Smokebox hinges	Okadee Company
Staybolt iron for rigid bolts and radial stays (rigid bolts hollow drilled)	Penn Iron & Steel Co.
Steam-pipe casing, Flextite type	American Locomotive Company
Superheater, Type E	The Superheater Company
Thermic syphons (2 in firebox; 1 in combustion chamber)	Locomotive Firebox Company
Throttle, American multiple-type	American Throttle Company
Tubes and flues	National Tube Company
Washout plugs	Huron Manufacturing Company
Water columns and reflex water glasses	Edna Brass Company
Whistle, steam	Consolidated - Ashcroft - Hancock Co.
Whistle blower, pneumatic	Davis-Lampton Company
Cylinders and Running Gear:	
Cylinders and bed frame, cast integral	General Steel Castings Corp.
Cylinder and valve bushings, Eddystone B iron	Baldwin Locomotive Works
Cylinder packing rings, Duplex sectional	Hunt-Spiller Company
Valve packing rings, Eddystone B iron	Baldwin Locomotive Works
Cylinder and valve head casings, chromium plated	
Cylinder cocks and automatic drain valves	Okadee Company
Drifting valves, Chicago automatic type	Ohio Injector Company
Driving and trailing tires, heat-treated	Midvale Steel Company
Flange oiler, for front driving wheels	Detroit Lubricator Company
Foundation brake gear	American Brake Company
Lateral motion device front drivers	American Locomotive Company
Lubrication for all rods, valve motion, etc., Alemite	Prime Manufacturing Company
Main driving-box bearings, Grisco-type	Gill Railway Supply Company
Hydrostatic lubricator, three-feed	Nathan Manufacturing Company
Mechanical lubricator, Schlacks	U. S. Metallic Packing Company
Pedestal wedges, adjustable	Franklin Railway Supply Company
Piston rod and valve stem packing, King type	U. S. Metallic Packing Company
Power reverse gear, Type G	American Locomotive Works
Radial buffer	Franklin Railway Supply Company
Rods, axles, guides, crank pins (Medium Class B, annealed carbon)	Standard Steel Works
Safety bar	Franklin Railway Supply Company
Springs, elliptic	Railway Steel Spring Company
Spring bands, cast steel	Standard Brake Shoe & Fdy. Co.
Springs lubricated when made with No-Ox-Id	Dearborn Chemical Company
Trailer-truck frame, cast steel (Arranged for future booster application)	General Steel Castings Corp.
Trailer truck cellars, Alco type	American Locomotive Company
Valves	Consolidated Ashcroft-Hancock Co. and Walworth Co.
Wheel centers, manganese steel	Standard Steel Works
Engine-truck bearings, roller type (5 locos.)	Timken Roller Bearing Company
(5 locos.)	SKF Industries, Inc.
Cab and Miscellaneous:	
Air gage, Quadruplex	Ashton Valve Company
Bell ringer, internal type	Transportation Devices Corp.
Brake valves mounted on sloping type pedestal	Westinghouse Air Brake Company
Cab curtains and awnings, Mule-Hide	Lehon Company
Cab windows, clear vision and storm	Prime Manufacturing Company
Cab side ventilators	Prime Manufacturing Company
Headlight, generator and classification lamps (Oliver type wiring fixtures)	Pyle-National Company
Lock nuts	Grip Nut Company
Paint, Opex lacquer	Sherwin-Williams Company
Sanders, triple type	Viloco Railway Equipment Co.
Speed indicator and recorder, Boyer type	Chicago Pneumatic Tool Company
Wire in conduit	Okonite Company
Wire in cab drops	General Electric Co.
Tender:	
Frame, Commonwealth water-bottom type	General Steel Castings Corp.
Tank, riveted, interior coated with No-Ox-Id	Dearborn Chemical Company
Truck brakes, Simplex clasp type	American Steel Foundries Company
Draft gear, Type A-78-XB	W. H. Miner, Inc.
Draft-gear attachments, Farlow	Symington Company
Draft key retainers, Sure-Lox	Western Railway Equipment Company
Dust guards, Security type	Western Railway Equipment Company
Truck journal boxes (Torsion-type lids)	Symington Company
Forged steel wedges, Top Notch	Railway Devices Company
Engine and tender connections (Oil, steam and air)	Barco Manufacturing Company

horsepower output is at least 50 per cent greater than that of the K-1 class, while at 15 m. p. h. it is practically 30 per cent greater.

Anticipated Decrease of 15 Per Cent Unit Fuel Consumption

It is expected that with a reasonably high load factor it will be possible to produce 1,000 g.t.m. with 7.42 gal. of fuel oil as against 8.73 gal. with the K-1 class. This means a decrease in unit fuel consumption of 15 per cent.

The tender is built on a General Steel Castings Corporation cast steel, water-bottom tender frame which utilizes space previously wasted, lowers the center of gravity for a stated capacity and reduces maintenance on account of the elimination of the bottom sheet of the tank and the wood decking formerly used. The tender capacity of 15,000 gal. of water and 5,000 gal. of fuel oil necessitated the use of six pairs of wheels. It is estimated that this capacity will permit operating a maximum distance of 84 miles without taking water and 330 miles without refueling. With water and fuel stations as now located, it is estimated that this tender capacity will eliminate three stops for water, one stop including refueling, on each trip over the 355-mile division on which the L-1 class will operate. The tender trucks are of one-piece cast steel construction, as are the locomotive trailer and leading trucks. Five of the engine trucks are equipped with Timken roller bearings and five with S. K. F. roller bearings, which is a new departure in the Cotton Belt territory.

Cylinders of 30-in. stroke were decided upon, due to the better tractive force curve than for a longer stroke; also on account of some expected decrease in maintenance because of lower piston speed. The Walschaert type valve gear is used, having a maximum travel of 7¾ in. and a maximum cut-off of 87 per cent. The power reverse gear is of the Alco type.

In addition to using high-tensile material for the boiler, other items of weight reduction, made use of in order to increase the weight available for the boiler, included hollow-bored driving axles and main crank pins. The main driving boxes are equipped with Grisco bearings, furnished by the Gill Railway Supply Company. Franklin adjustable wedges are used on all driving wheels.

The crossheads and the driving and trailer wheel centers, are made of high tensile manganese steel, the driving and trailer wheels being fitted with heat-treated tires. The driving wheels, being 70 in. in diameter over tires with 62-in. diameter centers, permitted satisfactory counterbalancing. The main wheels are cross-balanced. All of the revolving weights are balanced in each wheel, together with the desired amount of overbalance for reciprocating parts. The unbalanced reciprocating weight per 1,000 lb. total weight of the locomotive is 3.34 lb. and the static plus dynamic augment loading at diameter speed will not exceed the corresponding total for similar locomotives now in service.

The Class L-1 locomotives are provided with copper-bearing steel for piping and jackets; Alemite lubrication for 211 bearings; forged-steel valves for 400 lb. pressure and 750 deg. F. superheated steam and two Westinghouse cross-compound air compressors.

Various devices in the cab have been located so that the enginemen can conveniently operate them and the comfort of the crew has been well provided for by the installation of comfortable seats with arm rests, lockers and racks for supplies, tools and extra clothing; first-aid kit; clear-vision and storm windows; cab awnings and curtains; a radiator for heating the cab in cold weather, and five adjustable ventilators for warm weather; also the usual electric lights and ice water container.

Symmetrical Design and Lacquer Finish Give Attractive Appearance

The Cotton Belt management believes that a locomotive, neat and attractive in appearance, is a desirable asset. Therefore, the design provides for a symmetrical stream line appearance with straight running boards, hand rails and throttle rigging, as free from miscellaneous appliances, piping and other details as possible, although due consideration has been given to accessibility for repairs. The boiler and cylinder jackets have been finished with Sherwin-Williams lacquer in an attractive dark Nile green color. The cylinders and valve-chamber head casings are chromium plated and the main and side rods, as well as the valve gear, are polished.

The specifications for the locomotive were prepared by the mechanical engineering department who not only co-operated unusually closely with the builder, the Baldwin Locomotive Works, in working out the final details of the design to suit the special service and requirements of the customer, but supervised construction at the builder's plant.

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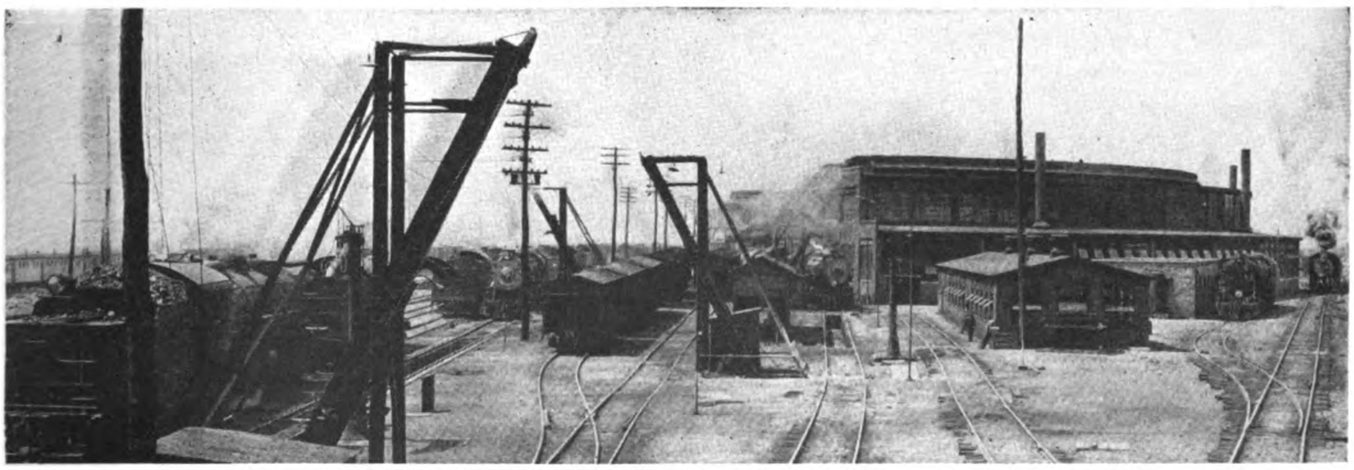


Facilities for outbound engines at the Portsmouth, Ohio, shops, Norfolk & Western—Engine supply house, old enginehouse, toilet and new enginehouse shown at right—Ash hoists and coal hoists at left

Action of Four-Wheel Freight-Car Trucks*

By T. H. Symington

The author describes the results of a research of the operating and maintenance problems of car trucks which have resulted from increased weights, greater rigidity and high speeds.

THE vital parts of freight cars are the trucks. We are using today the same fundamental principles in freight-car-truck design that have been in use for 75 years.

Modern heavy cars, some of great rigidity, operating at very high speeds, have brought with them many operating and maintenance problems. A scientific study of these problems and means for their solution are discussed in this paper.

There being no equipment in existence with which to make a proper study of the various problems involved, it was necessary to build two standard freight cars and equip them with much special apparatus which would give exact results. Each car is also equipped with 12 water tanks to provide any desired load. The two cars were necessary in order continually to have a yardstick with which to compare the performance of different appliances.

An accurate superimposed record is made on a recording table in one of the cars of the following actions on each car:

1—Speed in miles per hour.
2—All car-body roll in relation to the constant plane of Sperry gyroscopes.
3—All truck-spring movements on both sides of the leading trucks.
4—All vertical movements of the center line of each car.
5—All lateral movements between the car body and one side frame.
6—All movements, at right angles to the journals, between the journal-box wedge and the roof of the journal box.

A telemeter record is made of the magnitude and frequency of all transverse forces and of the forces of vertical acceleration resulting from spring oscillation or end shock.

Each car is also equipped with an accurate spring dynamometer with which to measure the force of vertical acceleration resulting from end shock and a Kreuger-cell instrument with which to measure both the force of vertical acceleration resulting from end shock and the same maximum force of vertical acceleration resulting from spring oscillation. Both cars are equipped with large periscopes through which to see and study all truck actions from inside the cars.

This research work naturally divides itself into four general headings, viz: Safety, Damage to Lading, Train Resistance, and Maintenance Costs. These are all so interrelated that it is thought best to discuss the truck as a whole and then in detail.

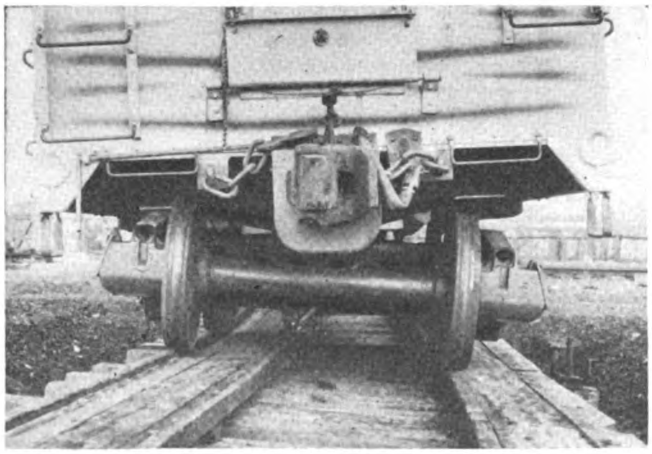
The Four-Wheel Truck

Wheel sliding can be prevented only by having both axles always radial to the curve. This has never been accomplished in a simple, efficient four-wheel truck design. The only truck yet produced where the axles are always radial to the curve is the Boyden six-wheel freight-car truck.*

This wheel sliding always necessitates, on any curve, a continuous high flange pressure against the rail of the outside leading wheel. No derailment on curves will result from this particular flange pressure unless the weight on this wheel is unduly reduced.

Cross-equalization—With flexible cars, the only cause of reduced weight on this leading outside wheel is excessive car roll that may put one-half of the entire body weight on one side bearing. With rigid-body cars and reduced side-bearing clearance, track warp may also put the entire weight of one-half the car body on one side bearing 25 in. from the center. Only 15 per cent of the load is then on one side of the truck, and this sometimes is not sufficient to keep the wheel on this side from mounting the outside rail. With large side bearing clearance, excessive car roll also may result in derailments on approach curves, whether the car is flexible or rigid, because of insufficient cross-equalization of load and increased swiveling resistance resulting from excessive weight on one side bearing.

If the load on one truck never can be more than 16 in. from the center, the minimum proportion of the load on one side of the truck is about 30 per cent, which



T. H. Symington bolster, 55-ton rigid car, with an 18-ton load—A.R.A. truck springs.

The outside rail on this 10-deg. curve is depressed to produce a track warp of 6 in. between truck centers when about 30 per cent of normal load is on the outside leading truck wheel.

* An abstract of a paper entitled "Research Relating to the Action of Four-Wheel Freight-Car Trucks," which was presented before the Railroad Division, A. S. M. E., Tuesday afternoon, December 2, 1930. The author is president of T. H. Symington & Son, Inc., Baltimore, Md.

* A description of the improved Boyden six wheel coördinating truck was published in the October, 1924, issue of the *Railway Mechanical Engineer*, page 602.

always is sufficient to keep a wheel from mounting the rail on curves from flange pressure.

The end views of the cars equipped with A. R. A. standard and T. H. Symington bolsters illustrate the two conditions—with and without cross-equalization. The desirability for increased cross-equalization of the load on all cars is obvious in the interest of safety.

When the load is so cross-equalized, there must be an auxiliary support at least 25 in. from the center in order to prevent any possibility of the car body rolling off the truck from centrifugal force when the car hits a curve at high speed.

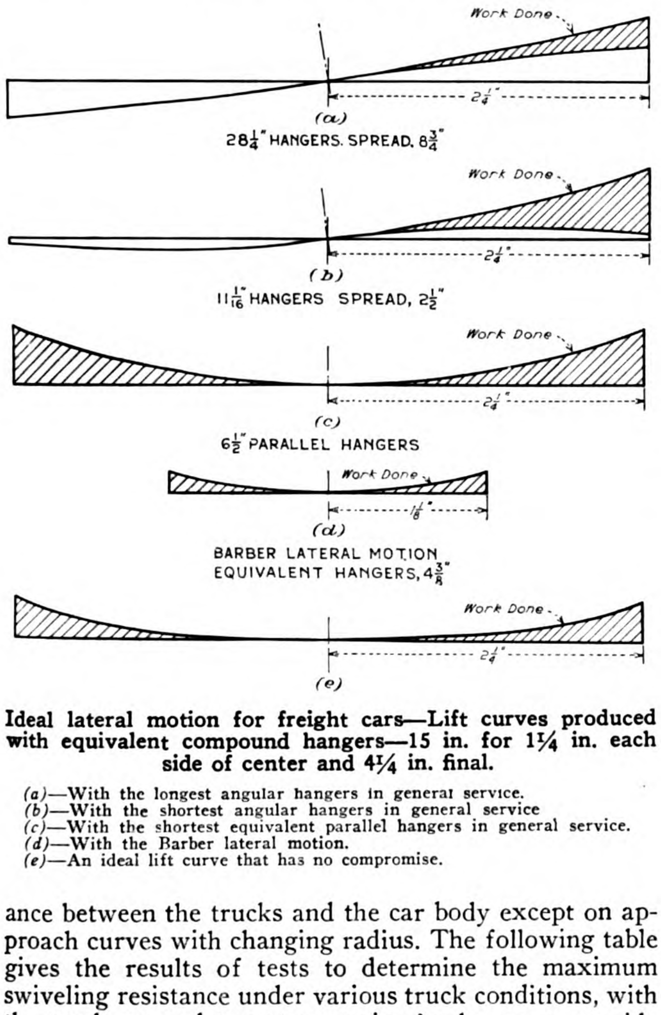
Some truck designers have thought that equalization in line with the rail is desirable on four-wheel trucks. Careful research has demonstrated that, while this equalization does no harm, it performs no desirable operating function.

A Derailing Condition

A derailing condition results from warp in the track between truck centers and not from the warp between wheel centers on one truck. By "warp" is meant the amount that one point on the rails is out of the plane of the three other rectangular points on the rails. The flexibility of the A. R. A. standard truck is always sufficient to permit one truck wheel to go down into a maximum-depth low joint without losing its share of the load on this side of the truck.

Swiveling Resistance—There is no swiveling resistance between the trucks and the car body except on approach curves with changing radius. The following table gives the results of tests to determine the maximum swiveling resistance under various truck conditions, with the track warped to put excessive loads on one side bearing. It shows the pressure required at the wheel flange to swivel one A. R. A. standard truck of a fully loaded 55-ton box car with the weight concentrated on one side bearing.

	Pressure, lb.
With friction side bearing	20,870
With roller side bearing	5,820
With T. H. Symington bolster	270

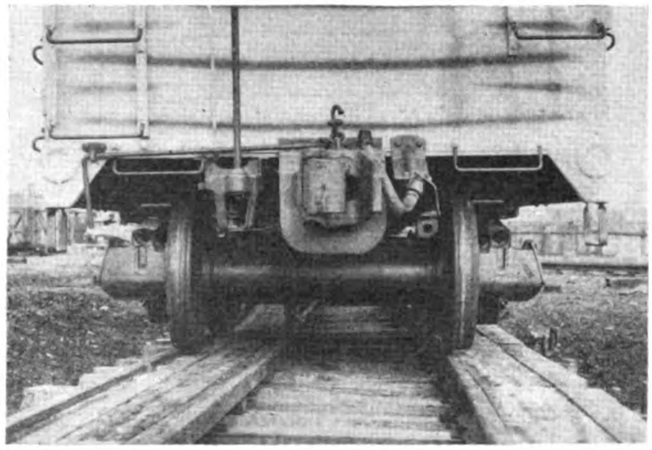


Ideal lateral motion for freight cars—Lift curves produced with equivalent compound hangers—15 in. for 1¼ in. each side of center and 4¼ in. final.

(a)—With the longest angular hangers in general service.
(b)—With the shortest angular hangers in general service
(c)—With the shortest equivalent parallel hangers in general service.
(d)—With the Barber lateral motion.
(e)—An ideal lift curve that has no compromise.

It is realized that this excessively warped track is found only occasionally in industrial yards, but the identical swiveling resistance is often encountered on main-line approach curves when the car body has rolled over to one side bearing.

Derailments—Most freight-car derailments occur when entering or leaving curves because, at these points on the line, the curve radius is changing and we have



A.R.A. standard bolster on 55-ton rigid car, with 18-ton load —Roller-side bearings have ⅛-in. clearance—A.R.A. truck springs.

The outside rail on this 10-deg. curve is depressed to produce a track warp of 2 3/16 in. between truck centers when about 15 per cent of the normal load is on the outside leading-truck wheel.

the combination of high flange pressure against the outside rail and minimum weight on the derailing wheel. On entering a curve, it is the rear truck that derails, and on leaving a curve, it is the leading truck that derails. The total flange pressure on approach curves is made up from the following three factors: The pressure necessary to slide three truck wheels, to swivel the truck, and the lateral component of car-body roll.

When the car body rolls toward the outside rail, there is a maximum flange pressure because all three factors of pressure are involved. This pressure may spread the track, break the wheel flange or shear off the journal-box-brass lugs, but never causes a derailment because, with standard cars, 85 per cent of the body weight is then on this side of the truck.

When the car body rolls toward the inside rail, only the first two factors of pressure are involved, but the outside wheel will sometimes derail because then only 15 per cent of the body weight is on this side.

The following table gives the results of tests to determine the derailing tendency on approach 10-deg. curves with different trucks on warped track representing a soft spot at the outside rail, when the load (rigid 55-ton box car with 18-ton load) was on the side bearing adjacent to the inner rail. Here, also, only the first two factors of pressure are involved.

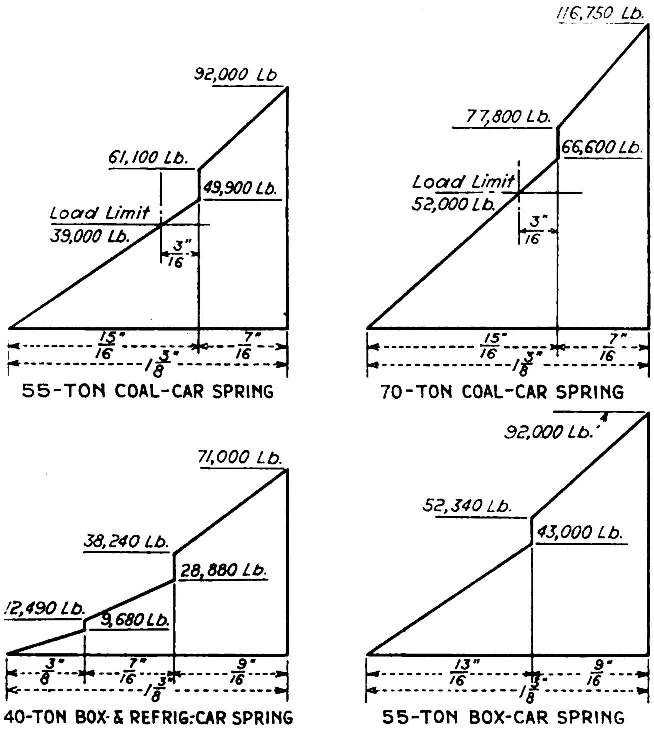
	Side-bearing clearance, in.	
	0	1/6
	Track warp, in.	
A. R. A. standard truck with A. R. A. standard bolster	1 9/32	2 3/16
A. R. A. standard truck with T. H. Symington bolster[1]	6	

[1] With this bolster there is no side-bearings clearance, and the truck will not derail until the body bolster comes in contact with the side frame.

Self-squaring—It is obvious that, on tangents, mini-

mum train resistance and flange wear result when the trucks are square and the flanges do not drag on the rails. Any design that will square a four-wheel truck after coming out of a curve and keep it square is worth considering.

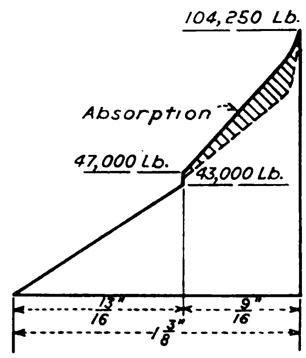
Any truck that will prevent the wheel flanges from exerting high pressure, first against one rail and then against the other, is worth considering, because both train resistance and flange wear are involved. This surging results from either car roll or car nosing. If side-bearing clearance is large, cars are apt to roll excessively. If too small, cars with standard trucks will nose.



Non-harmonic spring curves.

Car roll and nosing—If the synchronous impulses from the rail joints are not sufficient to cause objectionable, car roll, the truck will see-saw on its center plate, when there is sufficient side-bearing clearance, and not disturb seriously the mass of the car body.

If side-bearing clearance is a minimum or at zero, these vertical rail-joint impulses directly affect the car body mass with resulting nosing. This nosing originates from the car body. If side-bearing clearance is lacking, the truck cannot rock independently of the car body, and synchronous impulses from the rail joints will alternately compress the truck springs on opposite sides of the car. The lateral component of this action causes the car body to swing first to one side and then the other. This action occurs on all passenger cars. Without an easy lateral float of the car body on the trucks, the lateral movement of the car body will cause the trucks to surge first against one rail and then against the other and result in rapid end wear on brasses and journals. This nosing has the same period as car roll, and can therefore be identified with the synchronous timing of the rail joints at certain definite train speeds, often about 17 m.p.h.



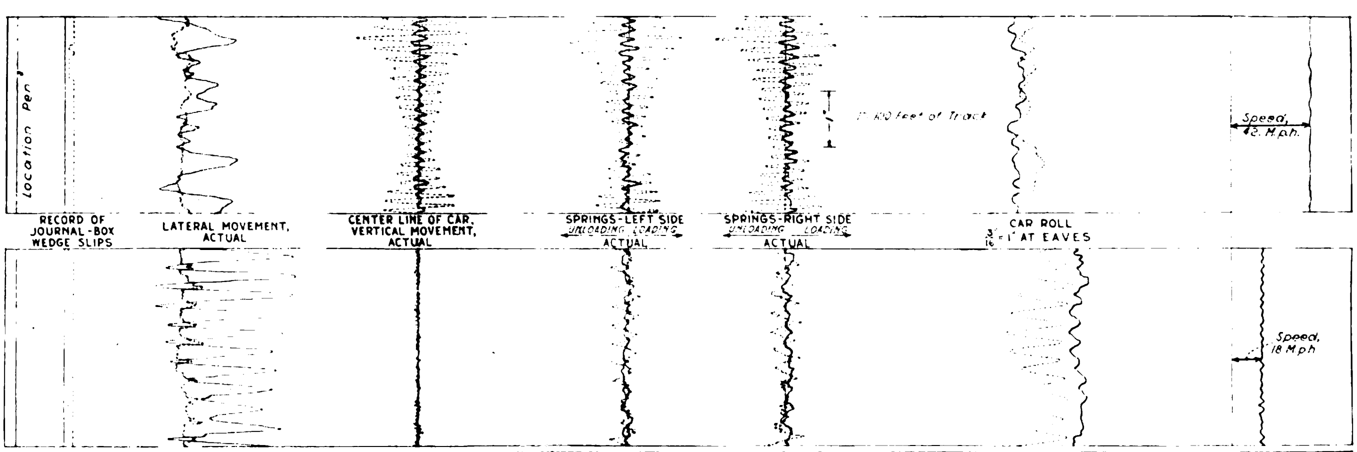
Spring curve of 55-ton box-car spring with one snubbed Edgewater unit.

Car roll can be reduced by reducing side-bearing clearance and by increasing the stiffness of the truck springs. Car nosing can be eliminated by increasing the side-bearing clearance or, with minimum side-bearing clearance, by providing a soft, easy lateral motion.

Either construction will break up any objectionable synchronous nosing action of the car body and truck in tune with the rail joints.

Safety—We have taken adequate care to prevent accidents resulting from the trucks by providing ample strength in the side frames and bolsters and in providing safety supports for the brake beams. We have done nothing to the trucks to eliminate derailments and to solve the broken-wheel-flange problem. An analysis of these problems indicates the need for better cross-equalization to prevent derailments and an adequate lateral motion on all freight-car trucks to minimize lateral shocks.

Guard-rail shocks—Car roll, or car nosing, will often take up all lateral clearances between the car body and the collar of one journal. If, at this instant, the opposite wheel flange strikes a guard rail at speed, something must yield in the line of force from the blow at the guard rail to the body mass, namely: The guard rail, wheel flange, journal collar, stop lugs on the brass, the side frame, bolster or the car body.



Specimens of research-car record with 40-ton springs in each car—spring-nest load of 17,350 lb.

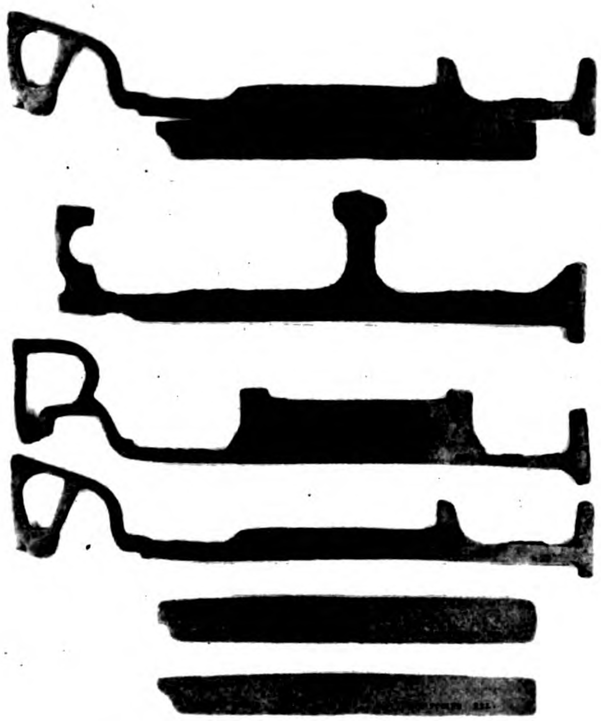
Full Lines: Car No. 1 with non-harmonic springs, full lateral motion (Curve e, of chart showing lift curves), and non-slip journal-box wedges. Broken Lines: Car No. 2 with A.R.A. springs, no lateral motion and standard journal-box wedges

If the blow is taken by the opposite journal shoulder, the force must pass through the top flange on the brass, and through the wedge to the roof stop lugs on the box on the same side of the truck as the offending guard rail.

This is nothing but a force of lateral acceleration. If we consider the weight on the rails of one truck of a fully loaded 55-ton car as 100, the body weight on one truck is 90 and the truck weight is 10. With adequate lateral motion, the mass to be laterally accelerated at one instant is the truck only, or 10, and the velocity of the lateral acceleration of one wheel is in direct proportion to the speed of the train and the entering angle of the guard rail. If we consider that, for a certain speed and guard rail, this lateral wheel velocity is 2, the lateral velocity of the center of gravity of the truck mass is 1. Then MV^2 for the truck = 10.

With a similar car, without lateral motion, we must add the force to laterally accelerate one-half of the car body with load. In this case the body mass equals 90 and the lateral velocity is 1, because, at any one instant, this lateral velocity of one-half of the car body is one-half of the lateral velocity of the wheel striking the guard rail. Then MV^2 for the car body equals 90 and the sum of the two equals 100.

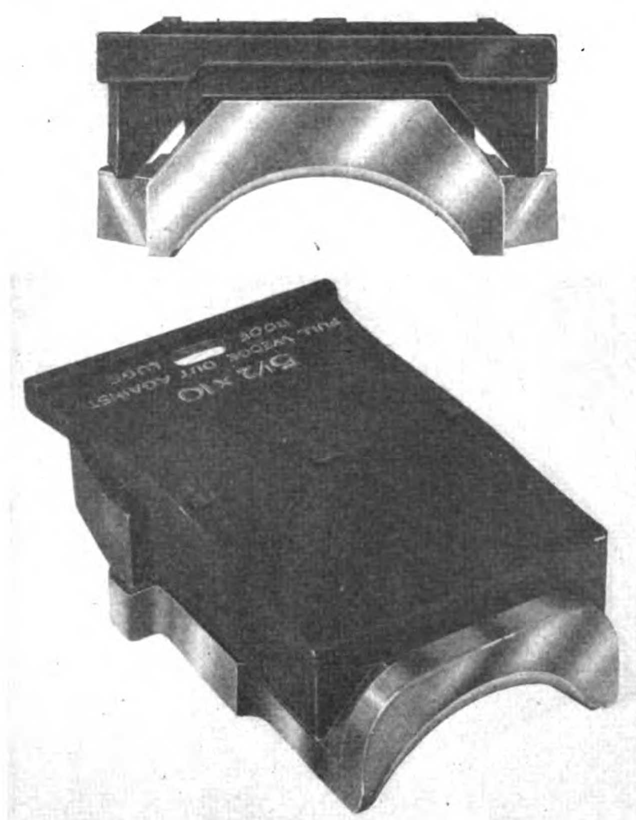
There are several factors of correction, namely, the lateral yield in the truck structure, the force needed to compress slightly the truck springs because of the small lifting angle of any lateral motion, and because the



Wear between top of journal-box wedge and roof of journal box.

lateral force on the car body is applied at the center plate some distance below the center of gravity of the car body. We are certain, however, that the force of lateral acceleration at the guard rail without lateral motion is many times this force when we have adequate lateral motion. The same advantages accrue from adequate lateral motion when the dynamic shock comes on the throat of the wheel flange.

If we can, with suitable lateral motion, greatly reduce



Construction of new wedge which is interchangeable with present standard wedge

this dynamic force, we automatically increase the factor of safety for the wheel flange many times and therefore largely eliminate broken wheel flanges.

If the wheel flange is strong enough to stand the shock, the brass is sometimes broken.

It would seem essential, therefore, that any lateral motion provide sufficient travel and gravity resistance so that there is *always* an ample reserve of yield to insure the minimum shock to the wheel flange.

It is fortunately a rather rare coincidence when a wheel flange strikes a guard rail at speed at the instant when all lateral clearances are absorbed in the opposite direction.

There is no doubt about the fact that there are many lateral shocks that are not sufficient to break a wheel flange or shear off the brass lugs, but are sufficient to break down the oil film on the journal collar, or shoulder, with resulting rapid end wear on brasses and journals.

Lateral Motion

An adequate lateral motion must accomplish two separate important functions: The floating action at the center must be easy in order to prevent nosing when side bearing clearance is at a minimum, and there must be sufficient travel and gravity resistance to insure lateral yield under all operating conditions and to prevent the bolster from striking the side frame.

This subject can be studied best with the swing-hanger construction used on all passenger cars, which operate with little or no side-bearing clearance. These hangers vary in length from 28¼ in., spread 8¾ in. at the bottom, to the equivalent of 6½ in. parallel hangers.

No matter what design is used, it is always a com-

promise to give the best results to eliminate nosing and provide sufficient yield and resistance.

With angular hangers, the bottom spread must be small to eliminate nosing and increased to give sufficient lateral resistance. If parallel hangers are used, they must be long enough to eliminate nosing and short enough to provide sufficient resistance in the usual travel of 2¼ in.

It is a good practice on a straight railroad to provide best against nosing, and on a crooked railroad to consider lateral resistance as of first importance. Pullman cars that operate on all sorts of railroads probably offer the greatest difficulty in this compromise between nosing and needed resistance.

An ideal hanger for all passenger cars would seem to provide a compound lift curve to produce an easy float at the center and ample lift toward the end of the motion. Shown in one of the drawings are lift curves:

(*a*) With the longest angular hangers in general service
(*b*) With the shortest angular hangers in general service
(*c*) With the shortest equivalent parallel hangers in service today
(*d*) With the Barber lateral motion
(*e*) An ideal lift curve that has no compromise.

Lift curve (*e*) can be produced either with compound swing hangers or with compression rockers.

It has been demonstrated that 6½-in. parallel hangers will induce little nosing on passenger cars with no side-bearing clearance. The reason is that combined helical and elliptic springs have a very flat load curve, and therefore largely absorb the effect of track irregularities without disturbing the car body.

On freight cars, with only helical springs, track irregularities are more readily conveyed to the car body, and an easier lateral motion at the center than on passenger cars is required to prevent the car-body swing from carrying the trucks with it. Curve (*e*) has therefore been found best for freight cars.

One objection to all swing hangers is that the lateral motion is continuous and the millions of movements necessitate a periodical renewal of pins and bushings in the hangers on account of wear.

With properly designed rockers, there is no sliding friction and the parts will last, with no deterioration, for the life of the car. When rockers, or rollers, are used for lateral motion, experience has shown that the car should be equally stable with the weight evenly distributed on the bolster, or concentrated on one rocker, which often occurs with rigid-body cars. This means that one rocker should give equal lift each way from central position. It is also important that the rocker-wear factor, viz., the product of its radius by its length, be sufficient to insure long life with ordinary steel rocker bearings.

Four-point Suspension—There has been much discussion about three-point and four-point suspensions. When cars are supported on four rockers, there is an even four-point support only on level track with rigid-body cars. Often the rigid-body car is supported on three rockers, and, on unusual track, the main supports may be two diagonal rockers instead of two diagonal side bearings, as on standard cars.

Many attempts have been made in the past to carry a freight car on four-rocker side bearings in order to minimize swiveling friction and reduce weight. The only well-known cars of this construction in service are 500 100-ton coal cars on the Norfolk & Western. They were designed for great flexibility, as a rigid-body car of this construction would not stay on the rails because there is no cross-equalization of the load.

With rigid-body cars, the rocker supports must be sufficiently close together to provide the essential cross-equalization of weight necessary always to maintain 30 per cent of the weight on the light-loaded wheel and thereby prevent derailments. If the rockers are not of conical form, provision also must be made to take care of the angular movement between the truck and body bolsters, or the mechanism will lock and derail the truck on a curve.

The only reason for increased swiveling resistance with roller side bearings when the weight is largely on one side bearing, is that the rollers are not of conical form, and therefore must slide a little on their bearings because of the angular movement between the bolsters.

When four rockers are used to support a car body, it would certainly seem desirable to arrange for gravity to square the truck when coming out of a curve. It is believed that this failure of the truck to square itself is responsible for increased train resistance and wheel-flange wear.

Barber Lateral Motion—The only lateral motion in general service on freight cars in this country is the well-known Barber lateral motion. This motion is the equivalent of parallel hangers 4⅜ in. long. With such short hangers, cars will nose if there is little or no side-bearing clearance. The travel of 1⅛ in., with a lift of 3/16 in., may not provide sufficient travel and resistance always to insure lateral yield. The makers of this device advise that, if desired, they can increase the travel and lift, which would give better action to prevent nosing and to provide needed travel and resistance to avoid lateral shocks.

The Truck Springs

With the large masses and high speeds of modern freight cars, the cumulative harmonic vibration of helical truck springs is responsible for a number of our operating problems.

Because of the small available space, freight-car truck springs are made in helical or coiled form, and also because the same springs must be suitable for empty or fully loaded cars and there must be no excessive variation in coupler height.

Harmonic Spring Oscillation—All helical springs have definite periods of vibration dependent upon the springs themselves, the mass supported by them and the speed. This vibration, without pendulum action of the car body, is in tune with the intermittent forces from the rail joints in the track at speeds of from 35 to 60 m.p.hr.

The resulting cumulative spring oscillation is probably the largest factor in damage to perishable freight and to truck springs. This oscillation is also a large factor in velocity train resistance and, in the author's opinion, for the initiation of transverse rail fissures when the springs go solid.

We have frequently recorded spring oscillation that closes solid A. R. A. spring groups of 40 and 55 tons capacity at the rate of three to four times per second.

All cars are subject to spring oscillation at certain particular speeds. We often identify one type of car as jumping when other cars are not jumping. This is because the critical speed for the other cars was not attained during the time of our observation.

Few railroad men realize that the shock inside a freight car from spring oscillation may cause a man to crash through an ordinary chair to the floor of the car. When once experienced, one can easily understand why

so much beef is found on the floors of refrigerator cars; why fat cattle lose from 10 to 15 per cent in weight in a long shipment to the stockyards; why certain fruits must be picked so green, in order to stand shipment, that they never reach perfection at a distant market; why we have so many spring failures on cars loaded to the rail limit; why such loaded cars do so much damage to rails. The breaking up of harmonic truck-spring action will automatically solve all of the above problems.

The first moves to stop the failures of truck springs under harmonic action were to increase the static capacity of the coils and then to add more A.R.A. standard coils and increase the static capacity of the spring group. Both actions materially helped to diminish spring failures, but had no effect in reducing harmonic spring action, except to increase the critical speed for this action. All such heavier-capacity groups will go solid under harmonic action when the track, the lading, and the train speeds are favorable to such action.

Concentrated effort is now being made by many railroads to break up this harmonic truck-spring action by the use of various means to introduce friction in the spring action so that the compression curve of the spring will vary materially from the release curve.

Excessive harmonic truck-spring action can be prevented by constructing spring nests that have irregular compression curves as illustrated in the chart showing the non-harmonic spring curves. The best general performance of springs was had with a spring group having the curve represented in the small chart showing the spring curve for one snubber unit. In this spring group, an Edgewater ring spring was under sufficient initial compression so that it was inoperative except under harmonic spring action. It is evident that any harmonic action tends to be broken up both by the sudden change of direction in the combined spring curve and by work absorption.

A great advantage in this spring-group construction is that the friction elements are only working in an emergency, and can therefore be relied upon for a long life. It is believed that a snubbed Frost spring in the same group would give approximately the same results.

The first essential for any truck spring would seem to be to prevent its ever going solid under vertical oscillation. The fiber stress then, at some point in a coil, might easily go to 250,000 lb. per sq. in., when there would be a certain failure. If one coil in a nest is broken, the spring group will thereafter go solid much more readily, with resulting destructive shocks to lading and to the rails.

It is believed by many engineers that excessive harmonic spring oscillations at critical train speeds may be caused by eccentricity of the wheels. Tests will be made to determine what, if any, reduction in harmonic spring oscillation can be effected with wheel treads ground concentric with the journals.

[Here the author gave a description of the methods for measuring the force of vertical acceleration and the various instruments installed in the two research cars. —Editor.]

The Journal-Box Wedge

A number of railroads are having difficulty with the wear between the top of the journal-box wedge and the roof of the journal box. If the wedge is harder than the box, the wear occurs in the roof of the box. If the box is harder than the wedge, the 78-in. radius on top of the wedge is worn flat. One of the illustrations shows a photograph of actual conditions as they exist. This is a serious matter, because, with loss of proper equalization on top of the wedge, there may result an excessive load at the front or back end of the journal that will cause a hot box.

Journal bearings often wear tapered, and if this tapered wear is coincident with loss of equalization on the wedge, a new brass will certainly have a concentrated load near the shoulder or the collar of that journal. A study has established the fact that all of this wear, resulting in loss of equalization, is caused by the wedge's sliding on the roof of the box at right angles to the journal.

It has been demonstrated that all journal brasses are normally against the outer center lugs in the journal boxes because they are pushed there by the brakes. It has also been demonstrated that there is a frequent movement of the journal and brass in the journal box, often to the extent of the clearance between the brass and the center stop lugs in the journal box. This play is always in excess of the lateral play between the beveled faces of the brass and the beveled faces of the wedge.

By increasing the play between these beveled surfaces, it has been found that wedge slippage in the box is entirely eliminated and the radius on top of the wedge can be reduced from 78 in. to 24 in., thereby providing better equalization of the load on the center of the journal, with no loss of this equalization due to wear. An illustration shows the construction of this new wedge, which is interchangeable with the present standard wedge. The wedge is hardened and is provided with three small beveled lugs that gradually bed themselves into the roof of the journal box.

One blow from the journal shoulder drives this wedge against the front roof-stop lugs in the journal box, and thereafter it never shifts in the box. There is ample bearing surface to permit, without wear, transverse sliding and sliding in line with the journal between the flat bottom of the wedge and the flat top of the brass. It will be noted that provision is made to prevent any possibility of the standard brass upsetting in the journal box should there be a seizure between the brass and the journal.

Spring Planks

A study of the action of the A.R.A. spring plank on standard trucks has led to the theoretical conclusion that it performs no important function. The function of the spring plank is to hold the truck square; that is, to keep one side of the truck from getting ahead of the other. An exhaustive investigation of the actual fits of the four bosses of the A.R.A. side frame in the four holes in the spring plank has shown the manufacturing necessity for sloppy fits, which permit an initial large angular movement between the side frame and the spring plank. It is believed that if the bearings between the side frames and bolster are sufficiently long and close fitting, the bolster can be utilized to maintain essential squareness of the truck. The spring plank can then be dispensed with entirely and the truck weight thereby reduced about 600 lb. on each 70-ton car. When the spring plank is eliminated, it is a simple matter to arrange the truck so that the cost of changing wheels is largely reduced.

It is not considered sound from a purely engineering angle to tie the side frames together at the bottom to a fixed dimension when the tops of the side frames are not similarly controlled.

The bolster applies all lateral forces to the side frames, and, without a spring plank, we are certain that the reaction points are at the tops of the journals. Secondary lateral stresses in the side frames are thereby

minimized. Service tests are in progress to demonstrate the efficiency of this type of truck construction.

Side Frames and Bolsters

Cast-steel side frames and bolsters have been vastly improved in design in the past few years. Further improvement can be made. The ideal ultimate standards will have essential strength, minimum weight, and maximum wearing surfaces to insure long service life.

This will be accomplished by designs that minimize secondary stresses and prevent a concentration of such stresses at any points in the structure. Metal that is never adequately working also should be eliminated. It is believed that future specifications for these parts will be based largely on elastic limits.

There are today a large number of designs in current use that are not interchangeable and require a multitude of patterns and coreboxes. Brake-hanger brackets are also of various designs and degrees of efficiency and ultimately will be standardized. Manufacturing tolerances permit quite a difference in the lengths of side frames, and the practice will soon become general of mating side frames in the same truck as now holds in mating wheels on the same axle. As the normal position of each brass is against the outer center stop lugs in the box, it would seem proper to mate side frames on the basis of the distance between the faces of the outer center stop lugs and not from center to center of journal boxes.

Additional Research

When the writing of this paper was undertaken, it was believed that this entire research could be completed in time to tabulate all the results. Unforeseen delays have made this impossible.

It is considered premature to comment on truck-spring performance at this time. We first must get the record of performance of all types of truck springs at all speeds up to 60 m. p. h., and with various ladings. No tests have yet been made to measure the magnitude and frequency of lateral forces or of the effect of vertical spring oscillation on perishable freight.

An exhaustive program for joint freight-car-truck research has, been arranged between several of the larger manufacturers of trucks and springs and one of our important railroads. The results of this work cannot be included in this paper, but will, at a later date, be made public.

Discussion

F. H. Clark, consulting engineer, New York, in discussing Mr. Symington's paper, pointed out that the author's proposal was apparently to eliminate the center plate, and that the car body would be carried on rockers placed between the body and truck bolsters. He agreed that the spring-plank connection to the side frame could be dispensed with, and approved of the author's suggestion that side frames should be mated for length.

F. J. Herter, assistant engineer of car construction, Chesapeake & Ohio, Richmond, Va., agreed with Mr. Symington that derailment of freight cars, damage to car parts, and swiveling resistance which affects train resistance, deserve considerable research study. He pointed out that the bolster design proposed by the author eliminated side-bearing clearance, the existence of which frequently caused the car body to attain a large initial lateral velocity to produce car roll. The function of the rocker, he said, to provide lateral motion is effective in reducing high stresses due to shock resulting from flange impact with rails, including guard rails. He questioned whether or not the car body would overturn on the rocker in the event something should lodge on the rocker seat and restrict the rocker motion. This would, in effect, be the same as placing a rigid side bearing much nearer the center of the car.

Mr. Herter and a number of other speakers stressed the necessity of overcoming excessive spring oscillation. Experiments with a spring dynamometer to determine the vertical acceleration due to end shock, showed this to be more serious with respect to lading than spring oscillation. Mr. Herter said that the results indicate that the vertical acceleration must be due to the fact that the center of draft is below the center of gravity of the center-sill section. This was on the assumption that the test cars are of A.R.A. underframe construction, in which case there is an eccentricity of one inch or more. Similar studies with a fish-belly center sill to which the upward deflection would be at a minimum would be interesting. Mr. Herter questioned the advisability of decreasing the radius of the back of the wedge from 78 in. to 24 in., unless it was found that the force is not sufficiently concentrated to crush the material in the roof of the box.

Alan N. Lukens, mechanical engineer, Railway Steel Spring Company, New York, and member of A. S. M. E. Special Research Committee on Springs and also the Committee on Springs, American Society for Testing Materials, said that most of the springs in use, including the A.R.A. standard springs, were designed many years before scientific research had shown that the stresses were far higher than anticipated. The A.R.A. springs designed for a stress of 80,000 lb. per square inch solid, actually develop 93,000 lb. at that point. In addition, he said, while the stress developed by the rated load is not far from reasonable, the practice of loading cars to axle capacity regardless of the springs, subject the spring to stresses far beyond the reasonable limit.

In discussing the vertical harmonic vibration of springs, Mr. Lukens pointed out that elliptical springs generate considerable friction between the leaves during movement. This friction, if properly utilized, prevents the starting of harmonic vibration, which fact has led to many attempts to add some friction on to helical springs which may also prevent vibration. He commended Mr. Symington's suggestion to use spring snubbers, and said that the results of the research showed a distinct improvement over the present standard springs. Mr. Lukens suggested that space should be provided for groups of springs 12 in. wide instead of the present standard of 11 in. together with an additional inch or more in length.

Jos. K. Wood, consulting engineer, New York, suggested the use of springs of variable pitch which would tend to dampen vibration.

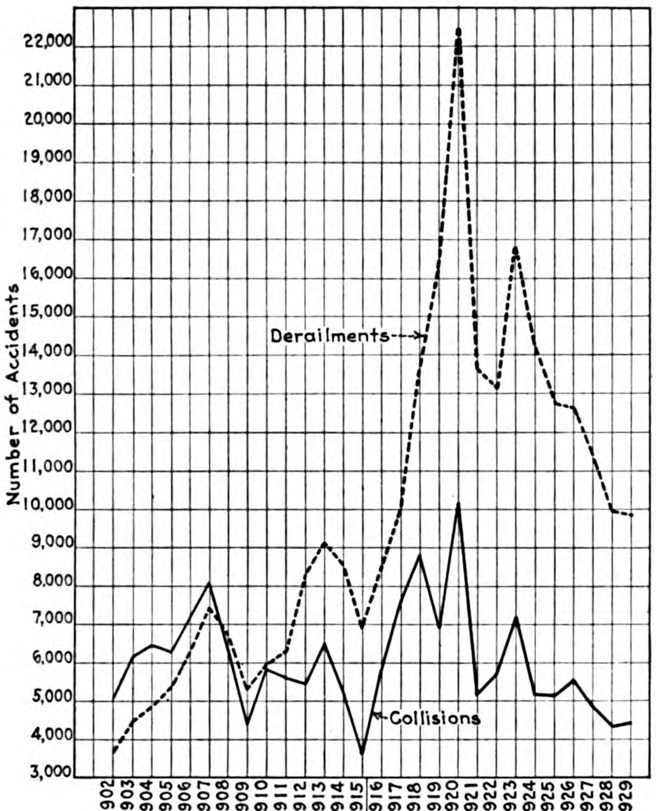
L. K. Sillcox, vice-president, New York Air Brake Company, suggested that a longer distance between truck centers as compared to the distance between wheel centers would obviate unequal weight distribution that tends to cause derailments due to track warps. He also brought up the point that the vibration of truck springs at critical speeds sometimes coincide with bridge vibration.

George G. Floyd, mechanical assistant to the president, American Steel Foundries, defended the four-wheel truck and pointed out that often derailments were charged to the design of the truck when the fault

actually lay with the handling of the train by the locomotive engineman. Improper handling of the air brakes, he said, tended to cause derailments.

W. E. Symons, consulting engineer, New York, referred to an investigation of car derailments which he made a number of years ago for a western road. The rigidity of the car structure, truck connections to the body and the design of the trucks themselves frequently caused the wheels, under certain conditions, to rise from the rail considerably above the depth of the flange. He also found that cars which rolled heavily at a certain speed would cease rolling at a higher and lower rate of speed. The length of wheel base, speed and track conditions, he said, were the governing factors, while side-bearing location and clearance were considered.

W. P. Borland, director, Bureau of Safety, Interstate Commerce Commission, stressed the need for improvements in the present design of car trucks from the standpoint of safety. Derailments, he said, were the most prolific sources of accidents. He compared the accident records for the periods from 1902 to 1911 inclusive, and for 1920 to 1929 inclusive. During the first period, he said, there were 61,329 collisions and 56,136 derailments; during the second period there were 57,382 collisions and 136,758 derailments, a decrease of 3,947 collisions and an increase of 80,622 derailments. The property damage from collisions for the first period, he said, was $48,235,952 and for the second period $57,450,943, an increase of less than $10,000,000; from derailments, $48,965,656 for the first period and $159,635,736 for the second period, an increase of more than $110,000,000. It should be borne in mind, Mr. Borland said, that these amounts refer only to damage to railway property and do not include amounts paid for lost or damaged lading, personal injuries or other claims growing out of such accidents.



Comparison of number of accidents caused by derailments and collisions

In a further examination of the accident record for the year 1929, Mr. Borland stated that of the total of 9,871 derailments reported, 4,510 were due to defects in or failures of equipment, while only 2,080 were due to defects in or improper maintenance of way and structures. There were 6,643 train accidents due to defects in or failures of equipment, of which 1,342 were attributed to trucks and 1,867 to wheels and axles. (Tables 63 and 65, Bureau of Safety Accident Bulletin No. 98.).

In considering all of these statistics, he said, the fact should be borne in mind that they include only those accidents which resulted in death, personal injury or property damage amounting to $150 or more. It is a matter of common knowledge that there are a large number of similar accidents not sufficiently disastrous to be included in these statistics but which are a constant source of delay and expense to the railroads and of trouble and worry on the part of railroad operating officers.

Research work of the character conducted by Mr. Symington, Mr. Borland stated, is therefore directed along lines which should be productive of important results. It is of direct interest to the Bureau of Safety, Interstate Commerce Commission, and should certainly enlist the active support of railroad officers who are responsible for the design, construction and maintenance of cars and for safe, efficient and economical operation of the railroads.

* * *

One of a series of advertising posters used by the Canadian National

Wheeling A Switcher In 37 Minutes

Shop facilities and the organization of a spot system has enabled the B. & O. to speed up locomotive repair work, reducing time in shop to a minimum

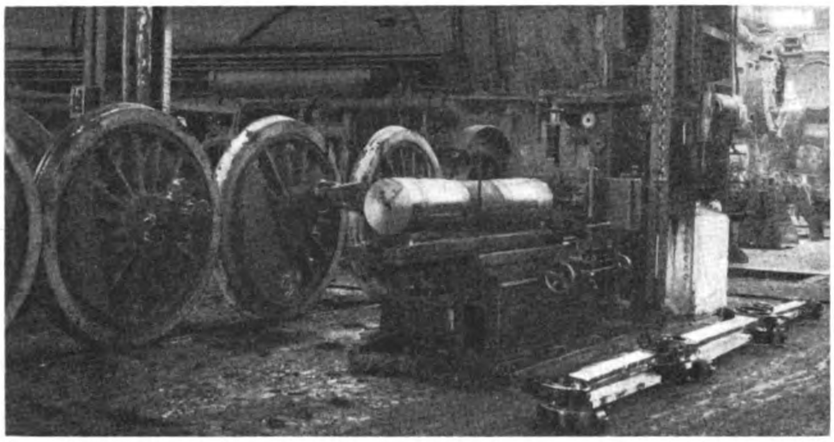


Fig. 1—The wheels and the rods on the machine shop floor

THE first glance at the title of this article may cause some readers to conclude that "here is another set-up job performed solely for the purpose of making a record that cannot be duplicated in every-day work." The title may be misleading, not in its presentation of a fact, but in the possibility that the reader may feel that the object of the article is to record an outstanding performance in wheeling a locomotive—such is not the case. Actually placing the driving wheels under an eight-wheeled switcher, ready to lift the engine over to another track, in 37 minutes is not in itself unusual but, the fact that the men and facilities in the Glenwood, Pa., shops of the Baltimore & Ohio have been so organized and supervised that 37-minute wheeling on such a locomotive is a week-in and week-out accomplishment, is unusual.

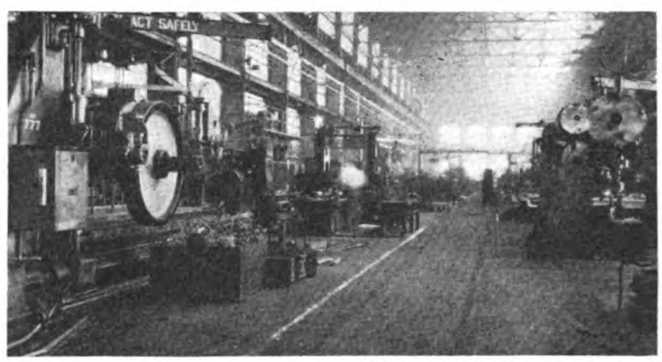
Wheeling a locomotive is but a small part of the job —in the case used as an example in this article requiring but 37 minutes out of a total of 1440 minutes that the engine was actually under repair in the shop—but the entire job has been so organized that the time spent in the shop by locomotives on the B. & O. has been reduced to a minimum. The spot system of locomotive repairs has been the means of accomplishment and the result is an output of two classified and one heavy running repair jobs for each working day.

The Spot System

For more than two years the Glenwood shops of the Baltimore & Ohio have been operating under the spot system. This system is particularly adapted to a longitudinal shop such as the Glenwood shop is. The idea was originally developed at the Mt. Clare (Baltimore) shops and has gradually been extended to other longitudinal shops on the B. & O..system. At both Mt. Clare and Glenwood the system is designed to produce an output of three classified repair locomotives each working day. In order to accomplish this, it has been necessary to take all of the visible lost motion out of shop operation and this has been done by attention to the little things that take time and interfere with the maximum daily output of individual workmen.

The spot system involved the separation of the shop relating directly to locomotive repairs into four general subdivisions: (1) A section where the stripping operations are performed on incoming locomotives and the finishing operations performed on outgoing locomotives; (2) a section for heavy classified repairs; (3) a section for light repairs; (4) a section of the shop known as the balance section. Into this section are placed locomotives involving heavy accident or rebuilding repairs.

Because locomotives going through a shop for classi-



Above—Fig. 2—Broad aisles and strategically located machinery simplify the job of transporting material and parts

Below—Fig. 3—At 3:35 p.m. this was the condition of the wheeling pit

Fig. 4—The four sets of drivers have been placed on the pit

fied repairs require such a wide variation of operations as between the lightest repairs and the heaviest repairs, it is necessary, in the operation of the spot system, to provide a balancing section in which to take care of those locomotives requiring unusual operations. These locomotives remain in the balancing section of the shop until the work on them has been brought to a stage where they may take their place in the regular line of locomotives passing through the shop toward completion.

After a locomotive is brought to the shop, it passes first through the stripping section from which it either goes to the balancing section if the work is of an unusual nature or else it is placed in either the heavy repair or the light repair section, depending on the nature of the repairs.

Glenwood is a dead-end shop and the erecting shop occupies an area of 90 ft. by 440 ft. in the center of the shop. Locomotives passing through the shop for classified repairs work their way down one of the outside tracks and back out of the shop on the opposite track. The center track is used for wheeling, unwheeling and, at one end for the locomotives occupying the balancing section. The preliminary stripping, sand-blasting of parts and inbound mechanical inspection is performed before the locomotive is placed on the erecting shop track so that when it actually enters the shop it is ready for the final stripping and unwheeling and ready to take its place in the progressive line.

The progress of the work covers 13 different "spots" at which different detail operations are performed and the locomotives in the shop are actually moved from spot to spot as the work progresses. The moving of the locomotives is taken care of by the second shift so that there is no interference with the actual productive work of the day-trick men. All wheeling and unwheeling is done on the second trick.

The heaviest repair jobs cover practically the entire length of the erecting shop on their way over the different spots while the lighter jobs may only move half-way into the shop then cross over and start back.

A Typical Example

In observing the functioning of the spot system at Glenwood, it was decided to follow the progress of repairs on Engine No. 637 which was taken into the shop

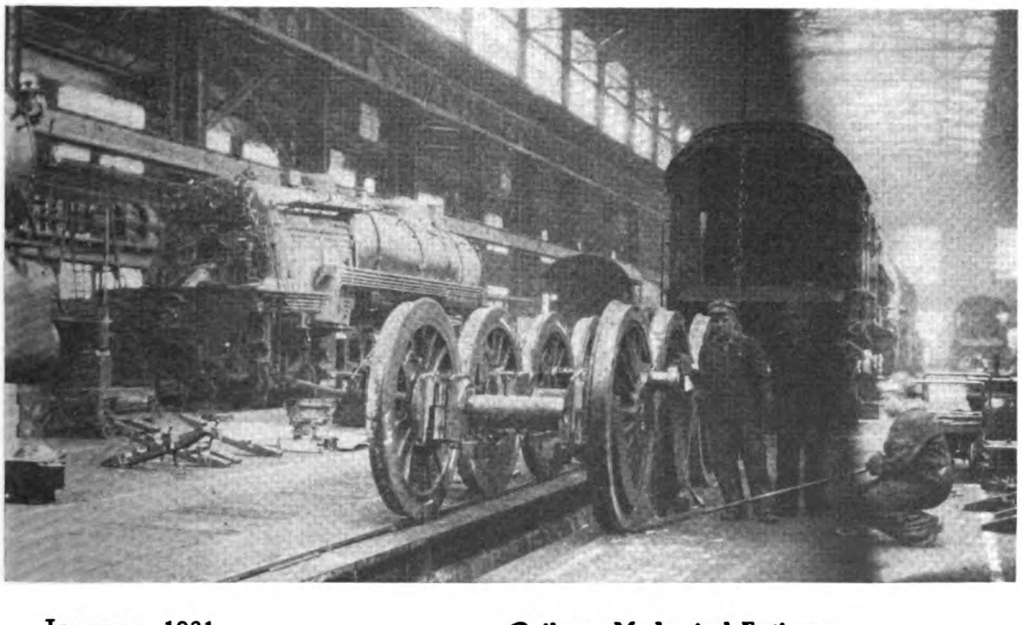
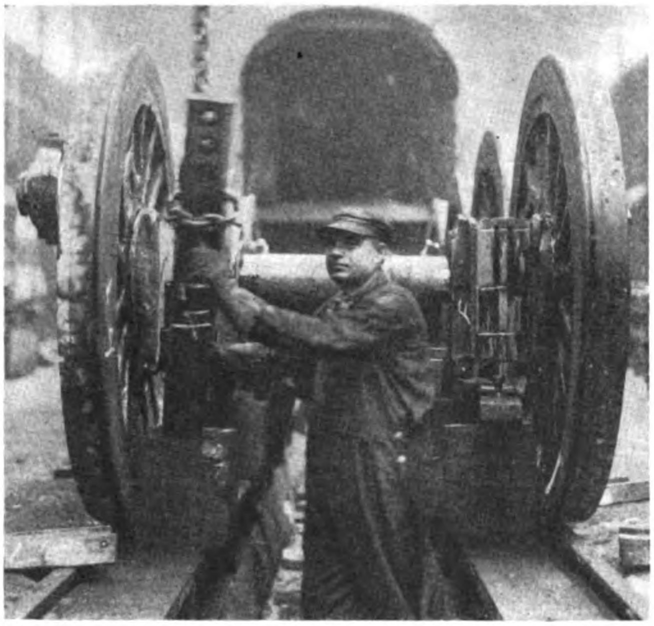


Fig. 5—The wheels have been trammed for location and the rods have been placed on the pins



wheels were taken to the wheel gang where all new tires were applied, the journals trued up, the main crank pins trued up and the eccentric cranks re-applied. The driving boxes were sent to the box gang where new crown brasses were applied and bored; new hub liners applied and faced; new grooved steel shoe and wedge liners were welded in place and planed and a new special type of journal bearing lubricator using oil instead of grease was fitted to each box. The rods were sent to the rod gang where new brasses and bushings were applied and finished; the spring rigging was sent to the spring gang where new pins and bushings were applied and similar repairs were made to the brake rigging by the brake gang. The shoes and wedges were renewed where necessary and planed; the binders were sent to the blacksmith shop for closing in and, upon re-application, several new binder bolts had to be made and applied.

The boiler work reported to the shop and included in the repairs consisted of rewelding 20 leaking flues, renewing four arch pipes, bobbing and cupping leaking staybolts and radials, renewing the front-end netting, washing the boiler, testing the boiler, patching a leak on the left side of the tank and repairing a leak in the back of the tank.

Fig. 6—The pedestal binders are placed on blocks under the driving boxes to facilitate handling

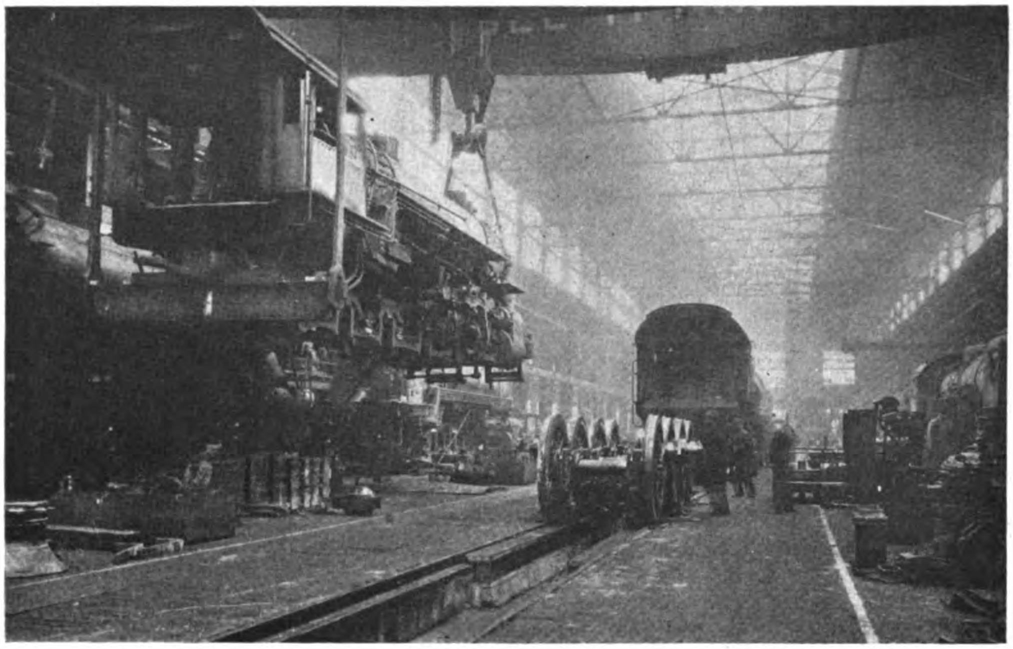


Fig. 7—Lifting the engine over to the wheeling pit

at 7 a. m., on a Tuesday to be given Class 5 repairs. The work reports showed only the work requested by the operating department when the locomotive was sent to the shop. In addition, the shop inspector at Glenwood found several other items of work that needed to be taken care of as the engine was going through the shop in order to put it in condition to run out the mileage in service demanded after the making of Class 5 repairs. One such major item of work performed but not reported on the original report was the renewal of the front bulkhead of the tank cistern.

Engine No. 637 occupied a position along with two other locomotives in Spot No. 1 of Section I of the shop on the Tuesday that it was taken into the shop. By 3:30 p. m. of that day the stripping operations had proceeded to such an extent that the engine was unwheeled by the second trick men and the major parts requiring repair or renewal were distributed to the different machine or repair groups throughout the shop ready to be worked on the following morning. The

While the above work was being taken care of the locomotive was progressing through Spots No. 7, 8 and 9 of Section III of the shop (the light repair section) to Spot 10 where, at 3:30 p. m. on Thursday it was ready for wheeling. This brings this article up to the point where the wheeling operation is about to be used as an example of the manner in which the shop functions on a difficult erecting operation so as to perform the job with the least effort.

An Erecting Shop Job

Advance preparation is an important part of any job and in this case the value is apparent. In the rearrangement of the shop for operation under the spot system the departmental groups and the machines and equipment therein have been located in such a manner as to eliminate so far as possible the handling of material or parts by manual labor. Even where cranes

are provided and power trucks are used, the arrangement has been such as to require the movement of parts over the shortest possible distance.

Some idea of the manner in which this has been worked out may be seen by the fact that the side rods and driving wheels in their movement from the rod and wheel gangs, respectively, to the wheeling location need move over a distance of not over 180 ft. The driving boxes, in moving from the driving-box gang to that point in the wheel gang where they are fitted to the journals, move only 48 ft. The grouping of machine tools and shop equipment in the machine shop at Glenwood has been worked out in such a manner that the different departmental groups are arranged with the idea of requiring the least handling of parts from locomotive to machine floor and from machine floor back to the erecting shop spot where the re-application of the material is made.

This brings us up to the point in our story where the actual wheeling operation is about to begin. In Fig. 1 may be seen the driving wheels and side rods for locomotive No. 637 as they appeared on the floor of the machine shop at 3:15 p. m. on Thursday afternoon. Fig. 2 is a general view taken from the same location, except in the opposite direction, showing the rod and axle department on the left foreground and the crank pin and rod storage location in the left foreground. It is along such aisle-ways that the finished material and parts move to the erecting floor.

As previously stated, the wheeling operation is performed on the second trick and in Fig. 3 may be seen the condition of the wheeling pit at 3:35 p. m. It is of interest to note that the wheeling pit has some special construction in that a shelf is built along the side of the pit next to the rail which, as may be seen later, is used for the blocks on which the pedestal binders are placed before the locomotive is let down on its wheels. There are two overhead cranes in the erecting bay, each of 100 tons capacity. One of these cranes may be seen on the runway while the other is in the background picking up the wheels from the machine bay.

In Fig. 4 we see a view at 3:42 p. m. By this time all of the driving wheels have been lifted over by the crane and placed on the wheeling pit. The pedestal binders may be seen on the floor to the right and to the left of the wheels. Another view, taken at 3:47 p. m. shows the wheels in position being trammed with the left side rods on and the right side rods just having been put on. The pedestal binders and the shoes and wedges may be seen on the floor. It might be well to mention here that the entire wheeling operation is performed by one machinist with one helper with the assistance of the two crane operators and a man who directs the movement of the cranes by signals from the floor. By 3:59 p. m. the blocks under each journal bearing, which are used to hold up the pedestal binders, have been placed on the shelf in the wheeling pit and the mechanic is seen placing the last of the binders on the blocks. Six minutes later, at 4:05 p. m. the binders are all up on the blocks, the shoes and wedges have been placed in position on the boxes, the rods are on and the locomotive is in the slings on the crane being lifted over from the adjacent truck to the wheeling location preparatory to being let down on

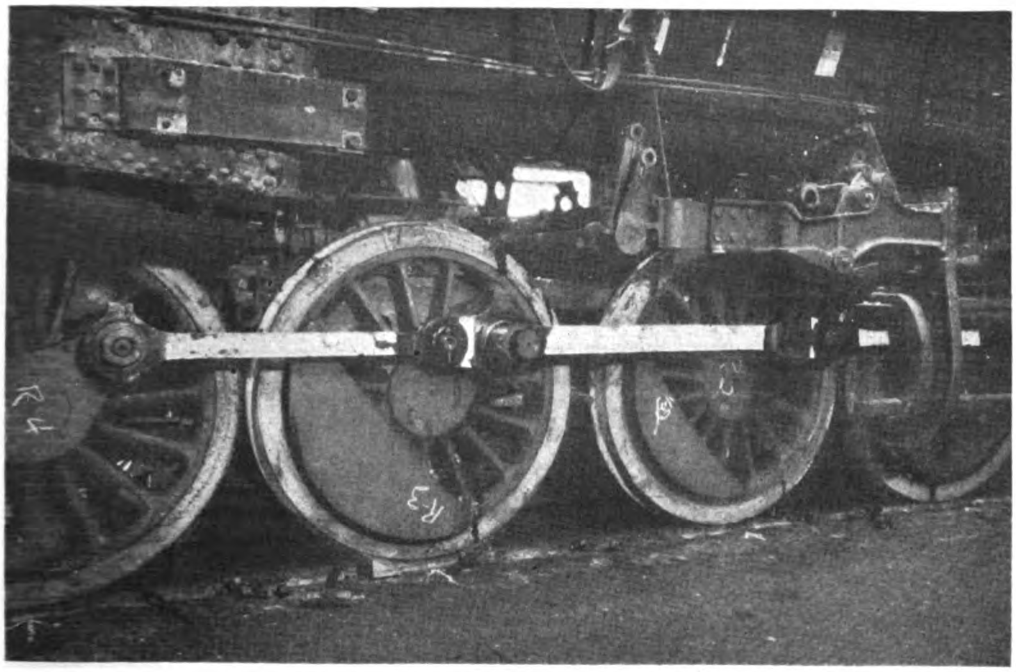


Fig. 8—At 4:08 p.m. the locomotive is down on the boxes and the binders are being set up

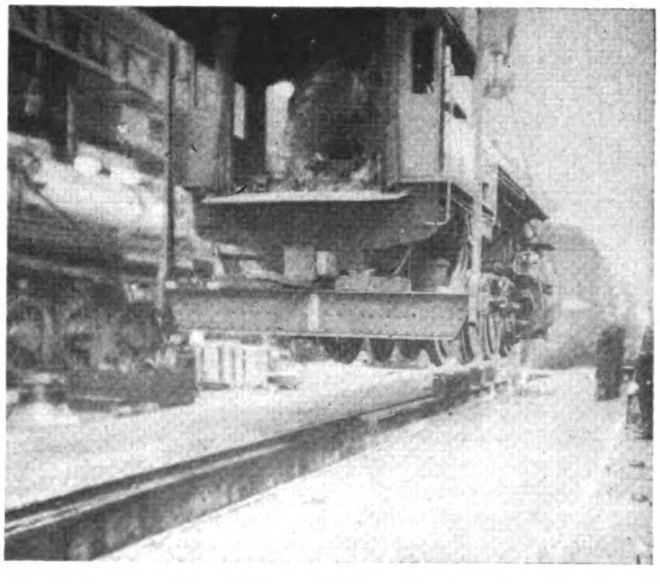
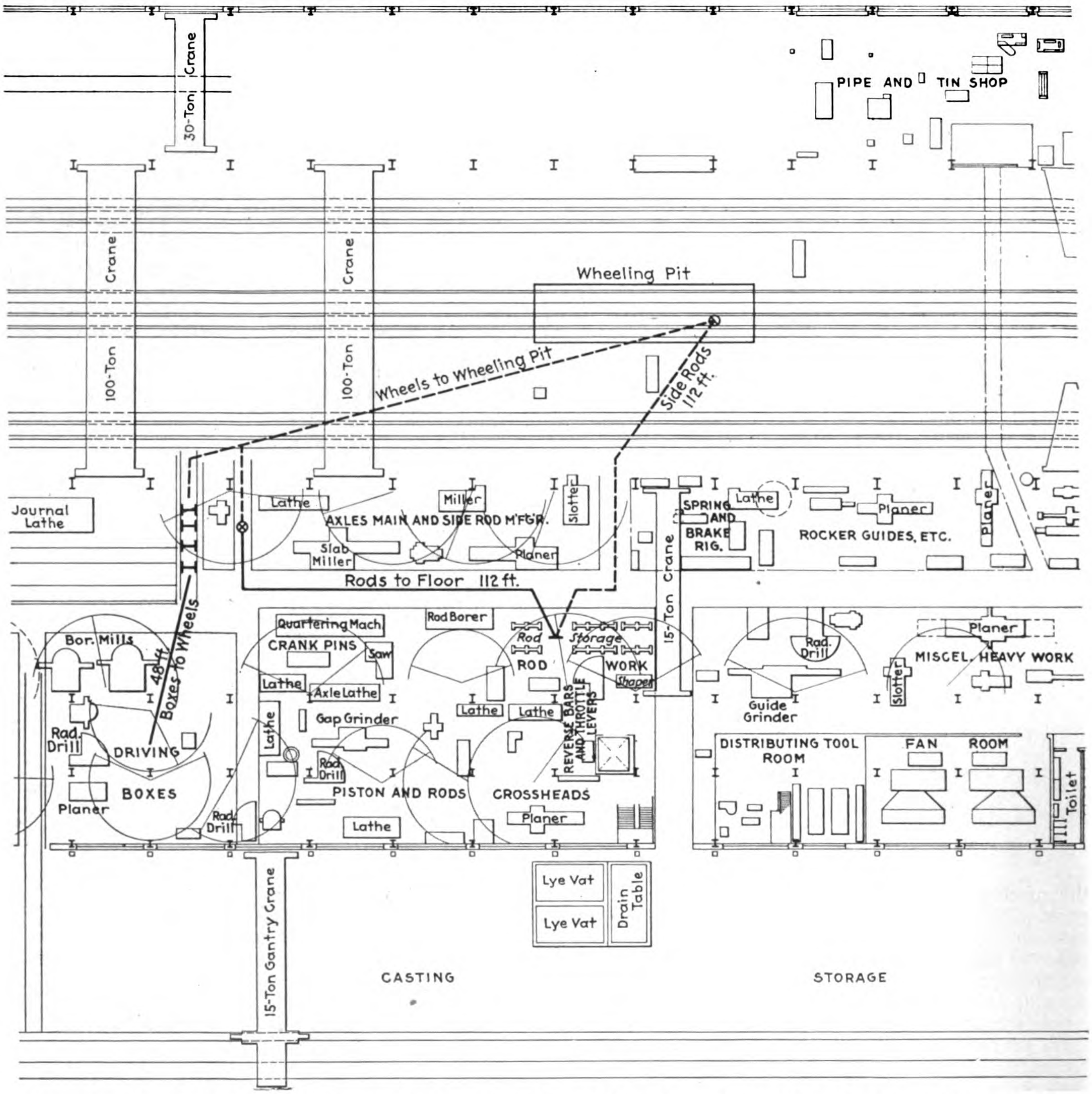


Fig. 9—At 4:12 p.m. the locomotive was lifted over to another track

the wheels. This is shown in Fig. 7. Fig. 8 is a close-up view of the condition of the running gear at 4:08 p. m. While this photograph was being taken, the mechanic and his helper were underneath the engine putting up the binders and setting up the binder bolts preparatory to lifting the engine off from the wheeling involves only the application of the wheels to the locomotive. This, of course, necessitates the putting up of the binders and the shoes and wedges but it does not include the application of the main rods, the application of the brake rigging or the final adjustment of the shoes and wedges or the side-rod knuckle-pin nuts. This



Arrangement and location of departments and routing of materials and parts in the B. & O. shops at Glenwood, Pa.

pit. The last photograph of the series is shown in Fig. 9 taken at 4:12 p. m. Here locomotive No. 637 is being lifted up from the wheeling pit to be moved to the spot in the finishing section where the final work will be performed on the engine preparatory to leaving the shop in service condition.

It is, perhaps, well to direct attention at this point to the fact that the wheeling operation just described work is performed in the finishing section. (Section I of the shop.)

This section, as previously explained, takes in both stripping operations on the inbound track and the finishing operations on the outbound track. In this section is also included the work that is done outside of the shop such as final testing, inspecting, firing-up and equipping for service.

Defective Locomotives Continue Decline

By A. G. Pack

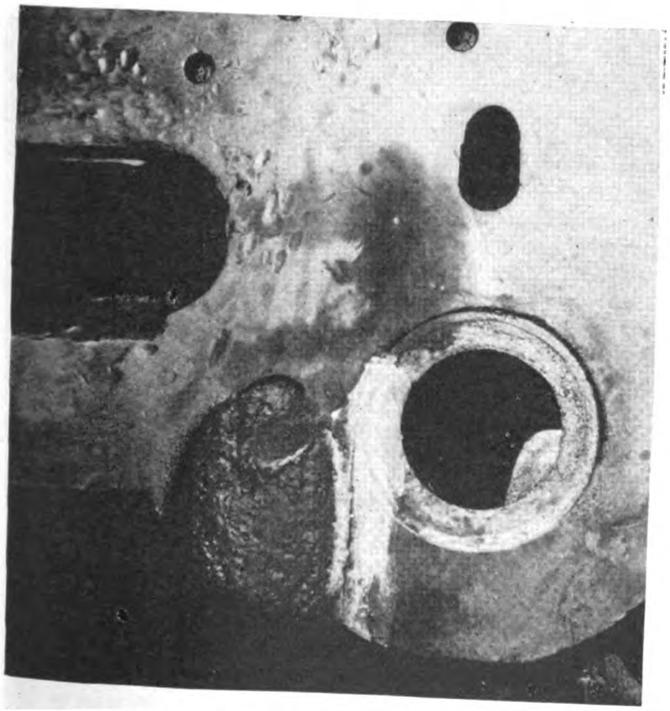
The nineteenth annual report of the Bureau of Locomotive Inspection to the Interstate Commerce Commission, shows steady improvement since 1923 and best record since 1916

ONLY 16 per cent of the locomotives inspected during the fiscal year ending June 30, 1930, were found defective according to the nineteenth annual report of A. G. Pack, chief inspector, Bureau of Locomotive Inspection, to the Interstate Commerce Commission. In addition, the report showed a decrease in the number of accidents and the number of persons killed or injured. Only 16 per cent of the locomotives inspected were found defective. There were 295 accidents which resulted in 333 casualties. This is the best record ever attained by the railroads since 1916, when the Bureau of Locomotive Inspection first began the compilation of statistics pertaining to the inspection of locomotives as they are now reported. There has been a steady decline in the number of defective locomotives, accidents and casualties since 1923, when 65 per cent of the locomotives inspected by federal inspectors were found defective, and there were 1,348 accidents which resulted in 1,632 casualties. Following is an abstract of Mr. Pack's report:

During the year 16 per cent of the locomotives inspected were found with defects or errors in inspection that should have been corrected before being put into use as compared with 21 per cent for the previous year. A summary of all accidents and casualties to persons occurring in connection with steam locomotives compared with the previous year shows a decrease of 17.1 per cent in the number of accidents, a decrease of 31.6 per cent in the number of persons killed, and a decrease of 17.9 per cent in the number injured during the year.

The decrease in accidents and casualties brought about by the decrease in defective locomotives, and the converse, are illustrated graphically by the curves on the chart.

Some of the carriers are maintaining their locomotives in condition approaching perfection while others are delinquent in this respect. The average percentage of locomotives on all railroads found defective has steadily decreased over a period of years reaching the low point of 16 per cent for the year ended June 30, 1930. Improved standards of maintenance reflected by the reduced percentage of defective locomotives have brought about the greatest degree of safety of locomotive operation ever attained.



A crack at the edge of a fusion weld in a crosshead on a locomotive about to be placed in service

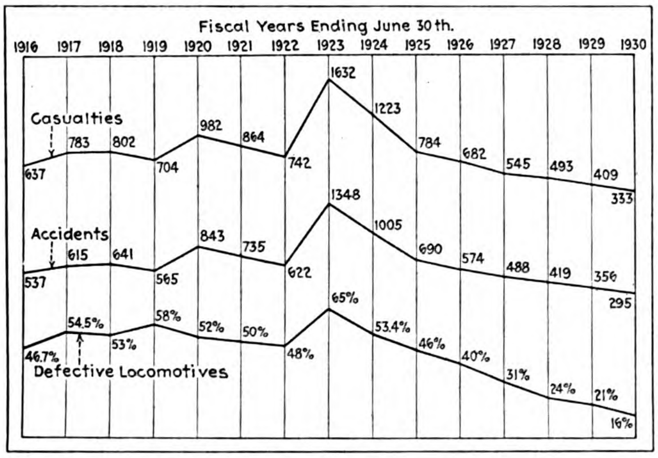
Boiler Explosions or Crown-Sheet Failures

Boiler explosions caused by crown-sheet failures continue to be the most prolific source of fatal accidents; 84.6 per cent of the fatalities during the year were attributable to this cause as compared with 68 per cent in

Number of Steam Locomotives Reported, Inspected, Found Defective and Ordered From Service

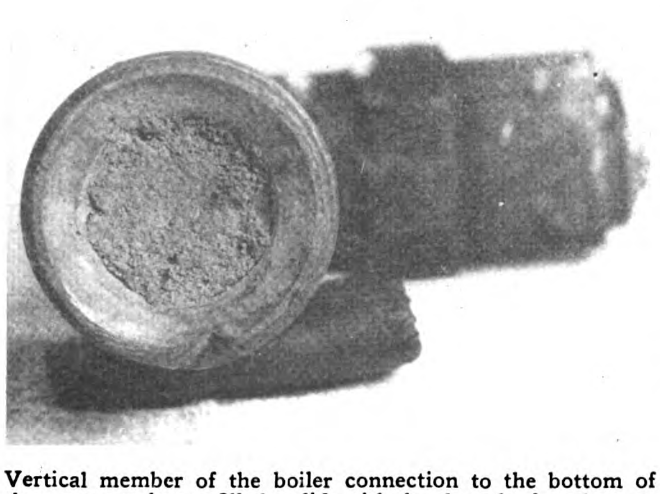
Parts defective, inoperative or missing, or in violation of rules	Year ended June 30					
	1930	1929	1928	1927	1926	1925
1. Air compressors	873	1,202	1,282	1,679	2,151	1,574
2. Arch tubes	87	104	103	127	204	198
3. Ash pans and mechanism	76	132	133	192	211	216
4. Axles	12	20	7	13	8	14
5. Blow-off cocks	325	442	469	650	780	825
6. Boiler checks	521	761	914	1,043	1,200	991
7. Boiler shell	579	841	954	1,422	1,888	1,597
8. Brake equipment	2,706	3,894	5,214	6,572	7,062	6,497
9. Cabs, cab windows, and curtains	3,066	2,140	1,670	2,055	2,666	2,541
10. Cab aprons and decks	710	1,005	852	1,086	1,307	1,165
11. Cab cards	226	305	378	575	696	665
12. Coupling and uncoupling devices	122	154	179	289	394	447
13. Crossheads, guides, pistons, and piston rods	1,421	1,887	2,088	2,602	3,018	2,922
14. Crown bolts	95	129	164	235	334	283
15. Cylinders, saddles, and steam chests	2,311	3,210	3,264	4,526	5,080	4,352
16. Cylinder cocks and rigging	848	967	1,007	1,634	1,904	1,801
17. Domes and dome caps	154	227	281	388	463	371
18. Draft gear	950	1,310	1,453	2,037	2,634	2,283
19. Draw gear	1,003	1,367	1,650	2,210	3,140	3,273
20. Driving boxes, shoes, wedges, pedestals, and braces	1,359	1,993	1,990	2,710	3,342	3,241
21. Fire-box sheets	471	657	730	796	1,129	1,152
22. Flues	254	334	464	465	556	524
23. Frames, tailpieces, and braces, locomotive	1,271	1,377	1,354	1,682	1,973	2,036
24. Frames, tender	177	297	256	264	373	391
25. Gauges and gauge fittings, air	290	309	461	721	886	694
26. Gauges and gauge fittings, steam	553	678	969	1,425	2,038	1,809
27. Gauge cocks	783	1,114	1,413	2,024	3,068	3,081
28. Grate shakers and fire doors	767	295	377	613	720	832

29. Handholds	865	1,125	1,373	2,285	3,100	2,831
30. Injectors, inoperative.	103	86	93	84	78	70
31. Injectors and connections	3,275	4,484	5,563	7,188	8,303	8,064
32. Inspections and tests not made as required	7,456	9,246	6,623	8,889	10,646	10,436
33. Lateral motion	372	618	699	673	758	659
34. Lights, cab and classification	119	121	118	107	106	86
35. Lights, headlights....	373	488	571	835	946	928
36. Lubricators and shields	312	423	500	746	883	704
37. Mud rings	445	636	822	1,073	1,458	1,384
38. Packing nuts	828	991	1,265	1,851	2,772	2,761
39. Packing, piston rod and valve stem	1,429	1,708	1,904	2,214	2,489	2,411
40. Pilot and pilot beams	272	371	386	507	638	832
41. Plugs and studs	348	482	619	740	1,087	849



Relation of defective locomotives to accidents and casualties resulting from locomotive failures

42. Reversing gear	579	788	967	1,247	1,539	1,274
43. Rods, main and side, crank pins, and collars	2,488	3,465	4,152	5,137	5,683	4,813
44. Safety valves	116	170	172	212	270	234
45. Sanders	804	1,008	1,031	1,268	1,769	2,004
46. Springs and spring rigging	3,311	4,557	4,939	5,956	6,826	5,532
47. Squirt hose	313	387	478	644	975	1,008
48. Stay bolts	395	542	590	631	905	741
49. Stay bolts, broken ..	1,098	1,197	1,867	2,373	3,582	3,745
50. Steam pipes	730	925	1,020	1,308	1,587	1,590
51. Steam valves	399	471	708	774	962	869
52. Steps	1,021	1,394	1,817	2,440	3,227	2,867
53. Tanks and tank valves	1,426	1,717	1,941	2,747	3,430	3,352
54. Telltale holes	183	174	241	377	487	451
55. Throttle and throttle rigging	1,175	1,554	1,889	2,233	2,618	2,403
56. Trucks, engine and trailing	1,141	1,605	1,914	2,363	2,860	2,966
57. Trucks, tender	1,531	2,144	2,610	4,114	4,929	5,372
58. Valve motion	827	1,067	1,262	1,568	1,576	1,250
59. Washout plugs	1,283	1,871	2,211	2,786	3,649	3,588
60. Train control equipment	48	60	112	....	....	....
61. Water glasses, fittings, and shields..	1,501	1,816	2,115	2,973	3,621	3,713



Vertical member of the boiler connection to the bottom of the water column filled solid with hard scale found on a locomotive about to be placed in service

62. Wheels	1,025	1,325	1,609	2,119	2,243	2,148
63. Miscellaneous—Signal appliances, badge plates, brakes (hand)	691	1,101	1,273	1,511	1,746	1,529
Total number of defects	60,292	77,268	85,530	112,008	136,973	129,239
Locomotives reported ...	61,947	63,562	65,940	67,835	69,173	70,361
Locomotives inspected ..	100,794	96,465	100,415	97,227	90,475	72,279
Locomotives defective ..	16,300	20,185	24,051	29,995	36,354	32,989
Percentage of inspected found defective	16	21	24	31	40	46
Locomotives ordered out of service	1,200	1,490	[illegible]	2,539	3,281	3,637

the previous year. However, there was a decrease of 35.3 per cent in the number of such accidents, a decrease of 15.3 per cent in the number of persons killed, and a decrease of 35 per cent in the number of persons injured as compared with the previous year.

The increasing size of locomotive boilers and the high pressures carried therein tend to increase the violence of explosions and cause increase in the fatalities per accident and increase in the seriousness of injury to those who are exposed and survive. Attention is directed to the necessity for the use of the safest and strongest practicable firebox construction, including the use of reliable boiler feeding and water level indicating devices. These questions have been referred to in my former annual reports in order that the number of this class of accidents and the effects thereof might be minimized.

Extension of Time for Removal of Flues

Two hundred and eighty-two applications were filed for extensions of time for removal of flues, as provided in Rule 10. Our investigations disclosed that in 12 of these cases the condition of the locomotives was such that extensions could not properly be granted. Nineteen were in such condition that the full extensions requested could not be authorized, but extensions for shorter periods of time were allowed. Forty-four extensions were granted after defects disclosed by our investigations had been repaired. Twenty-seven applications were canceled for various reasons. One hundred and eighty applications were granted for the full periods requested.

Specification Cards and Alteration Reports

Under Rule 54 of the Rules and Instructions for Inspection and Testing of Steam Locomotives, 1,242 specification cards and 7,500 alteration reports were filed, checked, and analyzed. These reports are necessary in order to determine whether or not the boilers represented were so constructed or repaired as to render safe and proper service and whether the stresses were within the allowed limits. Corrective measures were taken with respect to numerous discrepancies found.

Under Rules 328 and 329 of the Rules and Instructions for Inspection and Testing of Locomotives Other Than Steam, 70 specifications and 123 alteration reports were filed for locomotive units and 23 specifications and 6 alteration reports were filed for boilers mounted on locomotives other than steam. These were checked and analyzed and corrective measures taken with respect to discrepancies found.

Suits for Penalties

Eleven suits for penalties, involving 241 counts for alleged violations of the Locomotive Inspection Law and Rules, were pending in the various district courts at the beginning of the year. Information of violations was lodged with the proper United States attorneys in three cases, involving 39 counts. Judgments in favor of the Government were obtained in 11 cases, involving 236 counts; 107 counts were dismissed by stipulation or

(Concluded on page 26)

High-Pressure Steam for Locomotives

By C. F. Hirshfeld*

It is natural that in considering any radical change from past practice, designers should give thought to what has happened in more or less parallel fields, as for instance in that of the stationary power plant. Such developments may or may not be applicable to the plant required to move about as does a locomotive, but the facts cannot be determined except by analysis and possibly also by experiment.

When the locomotive designer begins to study recent stationary-plant development he discovers marked increases of steam pressure during a comparatively short period, and latterly an evident tendency toward radical increases of steam temperature. It is but natural to ask whether these are proper items for serious consideration in his field of endeavor.

In stationary practice there are two radically different conditions leading to the use of high steam pressure. The first is the higher thermal economy obtainable in condensing plant. The second is the greater quantity of power obtainable from steam expanded in engine or turbine and then exhausted, at pressures near or above atmospheric, for process or heating purposes. Such reasons have underlain an increase of average steam pressure from about 180 lb. gage in 1900 through 200 lb. gage about 1913 to about 450 to 500 lb. gage today with increases to 1,400 and 1,800 lb. in a few exceptional cases. The average steam pressure in representative locomotives is today about 220 lb. gage, with a pressure of about 280 lb. as the highest normal value. Higher pressures are in use, but may still be regarded as more or less experimental. The figure of 280 corresponds to the value reached in stationary practice in exceptional cases about 15 years ago, and in common use about ten years ago. I still remember the shaking of heads that accompanied the first increases above that value.

Erroneous Beliefs as to Thermal Economy

There is a popular belief that thermal economy increases indefinitely with increasing steam pressure and this belief has been responsible for quite a bit of loose thinking. Comparatively simple calculations suffice to show that it is erroneous.

*Mr. Hirshfeld is chief of the Research Department, The Detroit Edison Company, Detroit, Mich. He contributed this paper, of which an abstract and a summary of the ensuing discussion is given here, at the invitation of the Railroad Division, A. S. M. E., during the annual meeting of the society, which was held in New York, December 1 to 5, 1930, inclusive.

Progress Depends On Leadership

"Some thirty-odd years ago the stationary-plant engineer began a march of progress which probably represents one of the most remarkable advances ever made in a like period. It happens that my life in the capacity of wage earner started at about the beginning of this period, and that a teaching experience of some years caused me to become familiar with the history of power-plant engineering in the preceding period.

"The combination has often led me to contrast mentally the radically different rates of progress and to speculate as to the cause of such differences. At first I saw the cause in the development of this or that piece of equipment, but I have finally come to realize that the basic cause was a change in the outlook of the human beings who served as leaders. I am convinced that when the progress of stationary-plant engineering during the first third of the present century is viewed in retrospect, the most striking characteristic will be found to be the willingness of the leaders to cut loose from the past and to try new things, to strike out boldly into unexplored fields."

The thermal economies obtainable with various steam pressures and temperatures in condensing operation are shown in a convenient way in Table I. In preparing this table certain assumptions were required; it is not believed necessary to recite them here.

Suffice it to say that they were so made that the figures given are directly comparable, and that these figures give conservative values for well-operated turbine equipment of moderately large size as found throughout the country.

A brief survey of these figures will show what appear to be extraordinarily good performances for low-pressure, low-temperature plants. The figures are believed to be approximately correct in this respect. They reflect the fact that during the progress to higher pressures and temperatures we have made other improvements in plant design. If these improvements were carried back to the low-pressure plant, the performance of the latter would be much better than the performances mentally associated with such pressures. This is a fact which should not be overlooked; at least a good part of the credit that has been given popularly to higher steam pressures in modern plants belongs properly to improved plant design.

For the purpose of indicating both the thermal advantages and limitations of higher pressures and temperatures in condensing operation, a few numerical relations will be considered. Take, for example, the decreased heat consumption resulting from the increase of pressure at a given temperature and using the Rankine cycle, that is, without regenerative heating. These values, taken from Table I, are plotted in Fig. 1, using steam at various pressures but at a single temperature, namely, 700 deg. F. As a matter of fact the curve is partly non-realizable because beyond about 500 lb. initial pressure the water content of the steam at and near exhaust pressures would become too great to be economically usable with available turbine equipment. It is at once apparent that the great improvement with increasing pressure occurs in the lower ranges for such conditions as are indicated in Fig. 1, and that there is a reversal, that is, an actual loss if the pressure is carried high enough. It is questionable whether any pressure higher than 500 to 600 lb. could be justified for such conditions. A higher initial temperature

would alter the conditions slightly. With an initial temperature of 1,000 deg. F. there would be a continuous improvement up to and including 2,000 lb., but the total reduction in passing from 1,000 to 2,000 lb. would be only 350 B.t.u. as against almost 2,000 B.t.u. in passing from 200 to 1,000 lb.

A great part of the saving that is achieved through the use of high-pressure steam in condensing stationary

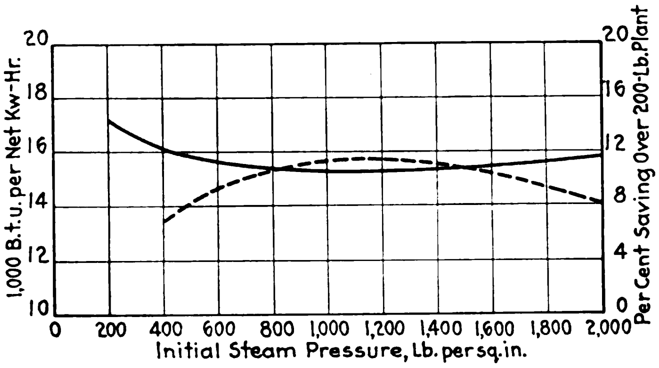


Fig. 1—Solid curve shows station-heat rate; Rankine cycle—No regenerative feed heating; Steam at 700 deg. F.—Broken curve shows per cent saving over 200-lb. plant

practice is achieved through the use of regenerative feedwater heating. The higher the pressure, the greater the effect of this process. Thus, using figures from Table I, the saving resulting from regenerative heating in four stages at 200 lb. and 700 deg. F. is 1,410 B.t.u., whereas at 2,000 lb. and 700 deg. F. it is 2,274 B.t.u. However, even with regenerative feedwater heating, the gains obtainable with like pressure increments become increasingly smaller as the pressure increases and ultimately reverses. This is shown in Fig. 2, which corresponds to Fig. 1. Comparison of the percentage curves of the two figures will show the effect of regenerative feed heating in increasing the saving resulting from increased steam pressure.

Inspection of these curves indicates that at 700 deg. F. there is probably little justification in exceeding about 600 lb. without regenerative heating and something like 800 to 900 lb. with four-stage regeneration, unless reheating be resorted to. In practice the limits are set in both cases close to 500 lb. because of the serious effect of condensate in the steam. The situation is naturally improved by increasing the initial temperature. If 1,000-deg. F. steam could be used, the practical or commercial upper-pressure limit without reheating would probably be in the neighborhood of 1,000 lb.

The question of whether condensing operation is possible or desirable with steam locomotives appears to be unanswered as yet. If the experiments that are now being made with condensing turbine-driven locomotives should prove such construction to be commercially feasible, the figures just given may serve to indicate the extent to which steam pressure may be profitably carried when viewed with respect to thermal considerations only.

There are, however, other considerations which may also be weighty, particularly in the case of locomotives. Thus, for example, high-pressure steam occupies much less space per unit of weight than does saturated steam. One pound of steam at 200 lb. absolute and 700 deg. F. occupies a space of 3.4 cu. ft., whereas the same weight at the same temperature, but at a pressure of 1,400 lb., occupies only 0.4 cu. ft. As a result of this fact, pipes and other parts for high-pressure steam may in fact weigh less than for the equivalent amount of low-pressure steam. Many peculiar effects follow from this and other characteristics of high-pressure steam, and it is almost certain that the thermal savings will not be completely determinative.

When non-condensing operation is considered we obtain an entirely different sort of picture from that disclosed above. I shall present it as it appears when considered with respect to industrial plants in which steam is exhausted for process purposes. You who are more familiar than I with the locomotive engine can translate my figures easily to the terms in which you deal.

Numerical values for this condition are given in

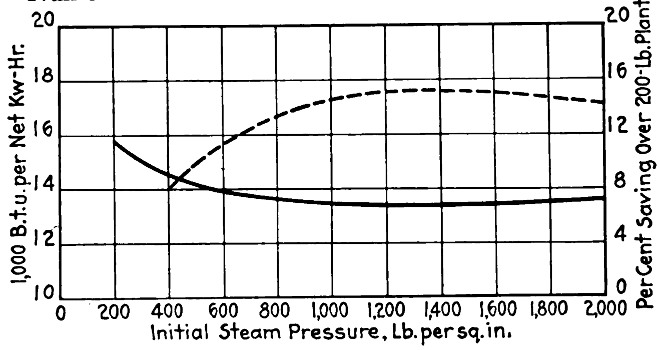


Fig. 2—Solid curve shows heat rate with four stages of regenerative feed heating and steam at 700 deg. F.—Broken curve shows per cent saving over 200-lb. plant

Tables II and III, and certain of the tabulated numbers and values obtained therefrom are shown in Figs. 3, 4, and 5. It should be noted that these values are developed for steam-turbine plant, and that large and small units, respectively, are considered. In reciprocating plant running under conditions of greatest economy the values would probably lie between those shown for the two sizes chosen.

The significant figures for non-condensing operation are those plotted in Figs. 3 and 4, giving the net output per 1,000 lb. of steam expanded down to 5 lb. gage pressure. Even at the low initial temperature of 700 deg. F., Fig. 3, an increase of output of over 20 per cent is obtained from a given weight of steam by raising the initial pressure from 200 to 400 lb. It is particularly interesting to note the comparatively small gains resulting from increasing the initial pressure above 800 lb., even at comparatively high initial temperatures.

A Comparison

"Looking at the steam locomotive through the eyes of an engineer who has concentrated his efforts in the stationary field, I am struck by the fact that it appears to have improved little during the period in which my own field of endeavor has made such rapid progress. To be sure, it has been made bigger, super-heaters have been adopted, feedwater heaters have been added, and so on, but the locomotive that I viewed with wonder as a small boy and the locomotive that I view more understandingly as a middle-aged man are essentially the same."

Decrease in Engine Size With Increase of Pressure

The curves given in Fig. 5 probably put this matter in somewhat more significant fashion for the locomotive designer. These curves show the decrease in "engine size" with increase of pressure. In this case this means area through the last set of blades and volume of exhaust casing. In the case of a reciprocating engine it would correspond roughly to piston displace-

ment under conditions of minimum cut-off. It will be noted that the decreases in engine size are really significant, and it should be remembered that similar or greater decreases occur in all steam-carrying parts. It will also be noted that the greater part of the decrease is attained in most cases by the time a pressure of 600 to 800 lb. is reached.

It is at least conceivable that the combination of decreased fuel consumption per unit of output and the decreased volume might be used in locomotive practice in either one of two ways. One would be the increase of capacity without increase of grate area or its equivalent; the other would be decreased size of parts for present output.

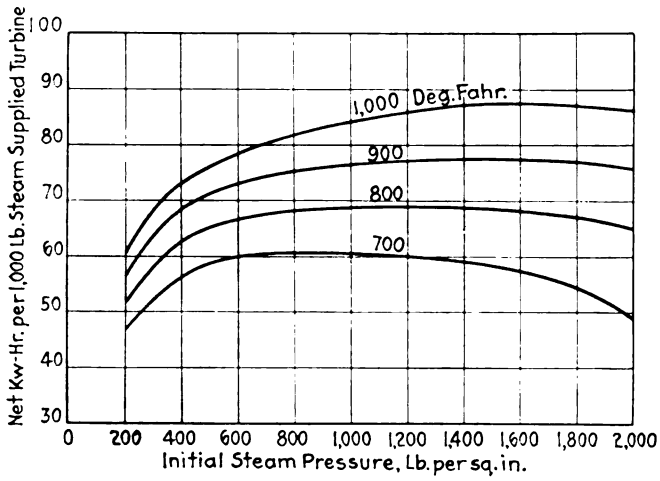


Fig. 3—Net power made available from a given weight of steam at various initial conditions and 5 lb. per sq. in. back pressure—Feedwater heated to 212 deg. F.—Large turbine plant (20,000-kw. units)

It would take more technical knowledge of the field than I possess to evaluate the significance of such possibilities. I shall have accomplished my end if I have shown you that, even in such simple matters as thermal performance and output per pound of steam, the situation is highly complicated and requires detailed study; that it is quite erroneous to assume that improvement in these respects must necessarily follow increase of steam pressure or temperature.

It should be helpful to consider what may be expected if theoretical considerations along such lines as are suggested above should show that radical increases of pressure and temperature promise worthwhile results in locomotive practice. Enough has been said to indicate that initial temperature is closely bound up with initial pressure in turbine practice. The same thing is true to some extent in reciprocating-engine practice, even in non-condensing operation. Therefore the consideration of permissible initial temperature appears to be the logical starting point.

Temperature Limitations Imposed by Metals

Experience with steam superheated above a temperature of 750 deg. F. is still too meager to make it safe to draw final conclusions with respect to higher temperatures. At present it looks as though carbon-steel tubes can be used safely to produce steam with a temperature of 800 to 850 deg. F., provided the metal temperature does not rise too high. The limit in this respect is taken at present at about 950 deg. F. provided the steam is practically free of oxygen when it reaches the superheater tubes. It is also necessary to design so that the unit stresses in the metal do not exceed something of the order of 4,000 lb. per sq. in.

The importance of oxygen-free steam cannot be ignored as experience indicates that very rapid attack upon the metal may be expected at such metal temperatures if any appreciable quantity of oxygen is present in the steam.

Table I—Thermal Performance of Condensing-Turbine Plant

Steam pressure, lb. per sq. in. abs.	Steam temperature, deg. fahr.	Station heat rate, B.t.u. per net kw-hr.: Rankine cycle (no regenerative heating)	Regenerative cycle: First stage feed heating	Second stage feed heating	Third stage feed heating	Fourth stage feed heating
200	700	17,170	16,230	15,980	15,840	15,760
200	800	16,420	15,590	15,330	15,220	15,120
200	900	15,800	15,000	14,740	14,630	14,560
200	1000	15,220	14,460	14,230	14,120	14,030
400	700	16,030	15,050	14,770	14,610	14,490
400	800	15,370	14,460	14,200	14,040	13,940
400	900	14,770	13,920	13,680	13,530	13,440
400	1000	14,240	13,450	13,220	13,090	13,000
600	700	15,580	14,520	14,230	14,070	13,960
600	800	14,900	13,930	13,660	13,500	13,390
600	900	14,320	13,420	13,170	13,020	12,920
600	1000	13,800	12,970	12,730	12,590	12,500
800	700	15,360	14,250	13,940	13,770	13,650
800	800	14,640	13,620	13,340	13,170	13,060
800	900	14,050	13,110	12,840	12,690	12,590
800	1000	13,530	12,650	12,410	12,260	12,170
1000	700	15,240	14,080	13,760	13,570	13,450
1000	800	14,480	13,420	13,120	12,950	12,840
1000	900	13,380	12,910	12,630	12,470	12,360
1000	1000	13,350	12,440	12,190	12,040	11,940
1200	700	15,210	14,000	13,670	13,490	13,370
1200	800	14,420	13,130	13,010	12,840	12,730
1200	900	13,760	12,750	12,460	12,310	12,200
1200	1000	13,210	12,270	12,010	11,870	11,770
1400	700	15,270	14,010	13,670	13,490	13,360
1400	800	14,360	13,230	12,910	12,750	12,630
1400	900	13,690	12,660	12,370	12,210	12,110
1400	1000	13,120	12,160	11,890	11,750	11,660
2000	700	15,780	14,300	13,910	13,710	13,560
2000	800	14,500	13,260	12,920	12,760	12,620
2000	900	13,610	12,520	12,220	12,040	11,930
2000	1000	13,000	11,990	11,710	11,570	11,470

This is also the temperature at which reaction between iron and steam begins to become noticeable. As a matter of fact, this reaction does not occur to a sufficient extent at 950 deg. F. to be at all significant, but it becomes of great importance at between 1,000 and 1,050 deg. F. The reaction is such that a very closely adherent magnetic-oxide scale is formed on the steam side of the tube and hydrogen passes off with the steam.

Higher temperatures may be used with alloy steels such as the nickel-chromium alloys and others which show higher creep strengths than the carbon steels. Such metals have been used in experimental equipment delivering steam at 1,100 deg. F., and there is no indication of short life due to creep, simple oxidation, or reaction with steam. Unfortunately the available alloys are all very high priced, and their metallurgy and physical behavior are not yet well understood.

These facts would seem to indicate that we are limited to steam temperatures of the

Necessary to Reconsider Problem

"If one may judge from the presently evident movements in the field, the economic conditions have altered to such an extent that basic changes in locomotive design are felt to be necessary. If this be the case, designers will have to bestir themselves and acquire a new point of view. No longer will it be sufficient to improve by whittling here and adding there. It will be necessary to consider the whole problem *de novo*, to depart temporarily from all the traditions of the past, to let the imagination have free rein in team with analytical ability. What will evolve may possibly be guessed at; it certainly cannot be predicted."

order of 800 to 850 deg. F. if restricted to carbon-steel tubing, and that we can probably extend this temperature to 1,000 or 1,100 deg. if the cost of the more expensive alloys can be justified. These figures immediately enable us to determine the highest steam pressures that show thermal advantages under any selected set of conditions. It must be realized, however, that the ther-

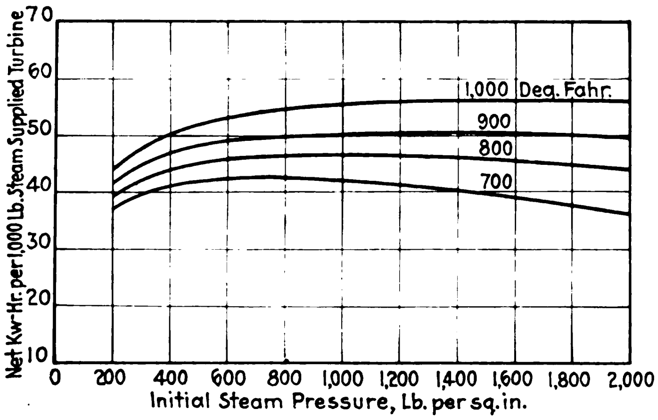


Fig. 4—Net power made available from a given weight of steam at various initial conditions and 5 lb. per sq. in. back pressure—Feedwater heated to 212 deg. F.—Small turbine plant (2000-kw. units)

mal considerations alone are not completely determinative. There are many others of operating and economic character which are equally important, and much more difficult to evaluate with respect to any particular field.

Boiler Characteristics at High Pressures

If one choose about 800 deg. F. as the highest temperature which now seems reasonably possible under locomotive conditions, it would appear from thermal

Table II—Thermal Performance of Non-Condensing-Turbine Plant—Large Turbines Exhausting at 5 lb. Gage

Steam pressure, lb. per sq. in. abs.	Steam temperature, deg. F.	B.t.u. per net kw-hr.	Net kw-hr. per 1000 lb. steam supplied
200	700	32,500	46.3
200	800	31,250	51.3
200	900	29,750	56.3
200	1000	28,000	60.8
400	700	26,750	56.0
400	800	25,650	62.3
400	900	24,650	68.3
400	1000	23,500	73.4
600	700	24,500	60.0
600	800	23,250	66.7
600	900	22,400	73.2
600	1000	21,250	78.7
800	700	24,000	60.5
800	800	22,500	68.5
800	900	21,650	75.5
800	1000	20,500	82.2
1000	700	23,900	60.4
1000	800	22,250	68.7
1000	900	21,200	76.4
1000	1000	20,000	84.5
1200	700	23,900	60.0
1200	800	21,850	68.9
1200	900	20,850	77.0
1200	1000	19,650	86.2
1400	700	24,200	59.2
1400	800	22,000	68.7
1400	900	20,750	77.4
1400	1000	19,400	87.0
2000	700	27,550	49.0
2000	800	22,500	65.0
2000	900	20,750	75.7
2000	1000	19,200	87.0

considerations as though a pressure in the neighborhood of about 800 lb. might be usable for non-condensing operation. It becomes pertinent to inquire into boiler characteristics at such pressures. Stationary experience with the higher pressures has been had with water-tube boilers exclusively, and with comparatively clean and pure boiler water. It is a long cry from such conditions to those found in average locomotive practice.

With properly designed water-tube boilers there has been no evidence of any intrinsic limitations to adequate natural circulation at pressures in the neighborhood of 600 to 700 lb., and there is no reason to expect such

Table III—Thermal Performance of Non-Condensing-Turbine Plant—Small Turbines Exhausting at 5 lb. Gage

Steam pressure, lb. per sq. in. abs.	Steam temperature, deg. F.	B.t.u. per net kw-hr.	Net kw-hr. per 1000 lb. steam supplied
200	700	40,650	37.1
200	800	40,000	39.3
200	900	39,250	41.8
200	1000	38,750	44.2
400	700	36,250	41.2
400	800	35,750	44.0
400	900	35,000	47.0
400	1000	33,900	50.3
600	700	35,000	42.5
600	800	34,000	45.9
600	900	33,250	49.0
600	1000	32,000	53.2
800	700	34,500	42.5
800	800	33,250	46.5
800	900	32,250	49.7
800	1000	31,000	54.7
1000	700	34,500	42.2
1000	800	32,900	46.6
1000	900	31,750	50.0
1000	1000	30,250	55.5
1200	700	34,750	41.5
1200	800	32,750	46.5
1200	900	31,350	50.3
1200	1000	29,900	56.0
1400	700	35,200	40.5
1400	800	32,750	46.2
1400	900	31,250	50.5
1400	1000	29,700	56.3
2000	700	37,000	36.5
2000	800	33,400	44.3
2000	900	31,500	50.0
2000	1000	29,500	56.0

trouble at 800 lb. On the other hand, when pressures of 1,200 to 1,400 lb. are reached, the forces causing natural circulation appear to be approaching such magnitudes that very small changes of design or condition may lead to serious trouble.

In this country we have succeeded in obtaining commercially satisfactory operation at such pressures with water-tube boilers of what one may call conventional design, but it has required careful design and careful operation. European engineers, on the other hand, calcu-

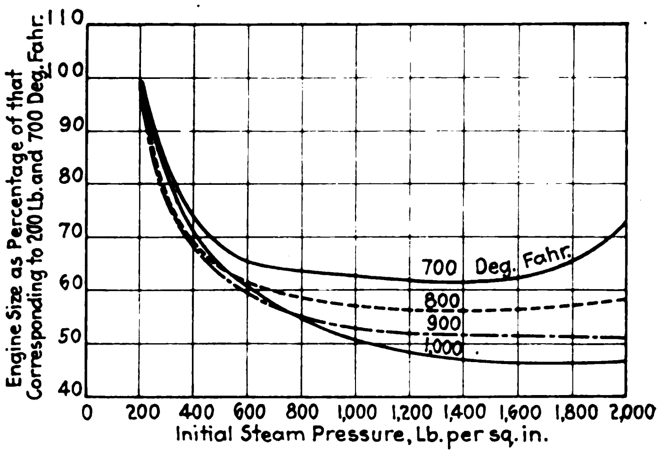


Fig. 5—Effect of initial steam conditions on physical size of engine—Large turbine plant—5 lb. per sq. in. back pressure

lated in advance the forces that should be available for creating natural circulation, and concluded that somewhere in the neighborhood of 1,200 to 1,400 lb. one entered the questionable region. It is possible that this is responsible for some or all of the radically new types of high-pressure steam-producing equipment now being experimented with in Europe.

Speaking first in general terms, the temperature of

saturated steam rises with its pressure. Thus, even though the metal surfaces be scrupulously clean on the water side and even though we assume the same thickness of metal in all cases, the average temperature of the boiler metal increases as the pressure under which steam is generated increases. It is also true that with similar structures the metal thickness would increase with pressure, so that at a given rate of heat transfer its average temperature would also increase slightly because of the slightly greater temperature drop through the metal. It is also obvious that an increasing rate of heat transfer through the metal must correspond to an increasing temperature drop through that metal and thus to a higher average metal temperature.

In stationary practice and with clean water no limit to increase of pressure has yet been set by such phenomena. However, two things of interest have been uncovered. An almost unbelievably small amount of scale on the water side in 1,200 to 1,400-lb. pressure boilers is fatal to those surfaces subjected to high rates of heat transfer. And it is possible to show by calculation that, with heat-transfer rates which may be regarded as possible of achievement, the metal of exposed tubes in a 1,400-lb. pressure boiler may reach temperatures at which the existing stresses will cause fairly rapid creep.

If one may judge from such meager evidence, it would seem that even if the locomotive boiler were modified structurally so as to adapt it to use with pressures of this order of magnitude, the feedwater conditions now characteristic of locomotive practice would make operation at such pressures impossible. In fact, I greatly doubt whether operation at a pressure as low as 400 lb. could be conducted commercially without great improvement over present feedwater practice as it exists throughout the country.

Feedwater Problem One of the Most Important

Looking at this field from the outside, I am impressed with the feedwater problem as one of the important ones that must be solved before any great advance of pressure can be contemplated safely. The situation of the railroads in this respect appears to me to be similar to that of the stationary plant of the better sort only a comparatively short time ago. It is only 17 years since the first equipment for supplying distilled make-up in condensing stationary plants was installed, and even now we are only beginning to understand the treatments required in cases in which we cannot return an adequate supply of condensate. I confess that I do not know just how the problem should be handled in railroad practice, but I am convinced that some better solution than that now in hand must be found before great increases in steam pressure can be safely contemplated for general use. It may be possible that the savings of various sorts that may be made through the use of higher pressures will be found sufficient to justify large, well-distributed feed-water-treatment plants, with transportation of treated water to various intermediate supply points. Or it may be that sufficiently skillful chemists can develop more perfect and simplified treatments which can be applied on the individual locomotive with such talent as is available in its operating crew. Or it may be that condensing operation will be found feasible, even though condensation be conducted at or near atmospheric pressure. I leave such considerations to those sufficiently skilled in the economics of railroading. But I do feel that the crux of the problem lies right in this factor, and that solution calls for radical thinking, for a deliberate reorientation and a new attack upon the problem.

I am also convinced in my own mind, possibly because of my ignorance with respect to the details of the problem, that the present type of locomotive boiler must pass out if much higher pressures are to be used with the maximum of economic results. Much as I admire the peculiar fitness of the present type, I cannot but feel that it represents one of those things which, surviving through its peculiar fitness, has served to limit the possibilities of improvement of major character. We have been through this thing in the stationary field and in the marine field, and it is possibly only natural to assume that we may expect a parallel development in the railway field.

Possible Locomotive Development for High Pressures and Temperatures

I have even been so bold on occasion as to endeavor to picture just what sort of boiler I would design for a high-pressure locomotive if that problem were put up to me. That it must have a water-cooled firebox is almost self-evident. That the water-cooled surfaces should take the form of tubes for high pressure instead of plates is almost equally obvious. I suspect also that the conditions of use are such that a large reservoir of steaming ability must be available in some form. Beyond these rather rudimentary specifications one would appear to have a very clear field, provided always that the problem of a satisfactory feedwater supply can be solved.

Such thought as I have given to the matter always brings me back to substantially the same picture, which I give you for what it may be worth. I conceive first of a rather large reservoir which shall be adapted to hold a volume of water substantially at boiler temperature and which shall serve as a source of steam supply to meet sudden short-time demands. Associated with this reservoir is a system of water tubes serving as a water-tube boiler. These form the firebox and, besides, give such added surface as is required to reduce the products of combustion to an acceptable temperature. Circulation through these tubes is produced by a pump which draws from the hot-water reservoir, and the tubular surface is so arranged as to discharge to that reservoir. The water tubes simply serve as a collection of heating paths starting at the pump discharge and ending at the pump suction, i.e., the reservoir from which the pump draws. Steam made is tapped off this heating system as required. I imagine that the pump speed will be regulated with respect to steam demand so that it will always circulate a large excess of water.

This may appear to you to represent very radical thinking. In one sense it is. In another, it represents a fairly logical mental extension of the path that we have followed in stationary practice. Whether it has any merit other than that of provoking comment and thus the exercise of the imagination, I know not. I do know that the imaginable solutions of the problem are so numerous that it is almost a foregone conclusion that our present one is not in all respects the best one, particularly when one considers its age and the air of assured respectability that age has conferred upon it.

One familiar with locomotive design will undoubtedly view with alarm the steam temperatures that have been suggested as desirable with higher pressures. Even a temperature of 800 to 850 deg. F. is not a pleasant thought in connection with locomotive engines of present design. But, once more, assuming that we retain the reciprocating engine, is the present design a necessary result? I think not.

It is almost certain that some type of poppet-valve mechanism will have to be substituted for the present types in which metal slides on metal. But I cannot see that this necessarily offers insurmountable difficulties.

Cylinder lubrication, as we now understand it, will also have to be abandoned. It is at least possible to conceive of a design of piston reciprocating in a cylinder which does away with actual metallic contact between these parts and, thus, with the necessity for cylinder lubrication of any sort. Guiding and support of the piston would then have to be taken care of externally and two packings would be required. Incidentally, packing against steam at high pressure and at a temperature of 800 deg. F. is no mean problem but even here promising solutions are now imaginable.

If we cut loose from present designs and adopt the condensing turbine solution, many of these problems disappear, but others of equal or greater magnitude make their appearance. However, they do not seem to me in my ignorance to be more difficult than many that have been solved successfully in other fields in recent years by the simple method of breaking completely from the conventional and considering all possibilities without too great reference to past convictions.

It seems necessary to call attention to one other feature of high-pressure plant that has not been touched on. The values given in Tables I, II, and III and illustrated in several figures were calculated on the basis of a constant boiler-plant efficiency. This involved an assumption which is important in the present consideration. This assumption was that the tendency of the temperature of the flue gases discharged from the boiler to rise with increase of steam pressure, due to the increased saturation temperature, was balanced by the proper addition of heat-absorbing surface of some form. A similar problem will develop in locomotive practice if very high pressures are resorted to. It may be that the economics of the situation will prove to be such that a net gain may result from the use of higher steam pressure in spite of a greater loss to the stack. On the other hand, it may prove necessary to install auxiliary heat-absorbing equipment, such as economizers or air preheaters. The facts can be determined only by a most detailed analysis and possibly by later experiment.

Discussion

H. B. Oatley, vice-president, Superheater Company, New York, complimented Dr. Hirshfield for recognizing the natural limitations imposed upon the locomotive-power plant. He agreed that the conventional form of locomotive boiler had nearly reached the limit of its usefulness and referred to the flat stayed surfaces of the firebox as a type of construction which should be scrapped for steam pressures above 300 lb. In lieu thereof, Mr. Oatley suggested the use of the water-tube firebox. He agreed with the author that high pressures will save weight.

James M. Taggert, consulting engineer, New York, also pointed out the unsuitability of the fire-tube boiler for use in connection with high pressures. He proposed the application of an economizer and air heaters. Mr. Taggart stressed the importance of giving serious consideration to the ultimate utilization of pulverized coal.

Prof. A. J. Wood, head of the mechanical-engineering department, Pennsylvania State College, defended the efficiency of the locomotive of conventional design. In his remarks he briefly reviewed the developments of a steam locomotive in recent years and stressed the fact that considerable had been accomplished within limitations which were well recognized.

A. A. Potter, dean of the school of engineering, Purdue University, announced that the Babcock & Wilcox Company is delivering an experimental boiler designed to operate at pressures ranging from 3,500 lb. to 4,500 lb. and a temperature of 833 deg. F. to the experimental laboratory at Purdue. The steaming capacity of this boiler is estimated at 5,000 lb. per hr.

Defective Locomotives Continue Decline

(Continued from page 20)

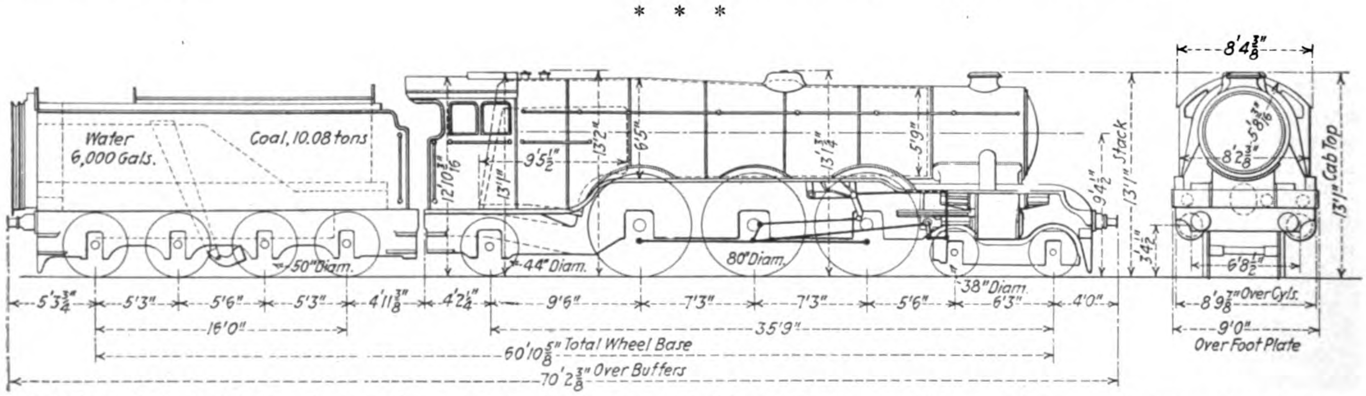
agreement and penalties imposed on 129 counts in the sum of $12,900. Three cases, involving 44 counts, were pending in the district courts at the end of the year ending June 30.

Amendments to the Rules for Inspection and Testing

The part of the commission's order dated February 21, 1929, promulgating Rule 118, applying to equipment of new locomotives with mechanically operated fire doors, together with the provision applicable to maintenance of fire doors became fully effective on April 1, 1929, and the part of the order applying to equipment of existing locomotives with mechanically operated fire doors when receiving classified repairs became fully effective on July 1, 1929. The terms of the order are being generally complied with. However some of the mechanically operated fire doors that were at first applied as a result of the order contained inherent defects that precluded proper operation; these are now being replaced by fire-doors that are apparently satisfactory.

No formal appeal by any carrier was taken from the decisions of any inspector during the year.

* * *



Elevation of the 4-6-2 type locomotives used by the London & North Eastern on its non-stop runs between London and Edinburgh—This drawing shows the tender before the corridor was installed

Cylinders, diameter and stroke, (3) 20 in. by 26 in. Weight on drivers, 134,000 lb. Steam pressure, 180 lb. Diameter of drivers, 80 in. Tractive force, 29,835 lb.

EDITORIALS

An "Outsider" Talks On Locomotive Design

The paper by Dr. C. F. Hirshfeld, chief of the research department, The Detroit Edison Company, on High-Pressure and High-Temperature Steam for Locomotives, which was presented at the annual meeting of the A. S. M. E., is an excellent example of the contributions possible from engineers employed in industries other than the railroad. His paper was prepared at the request of the Railroad Division—quoting Dr. Hirshfeld—"apparently in the belief that one familiar with modern developments in stationary-steam practice might be able to bring you useful thoughts and experiences from that field."

Dr. Hirshfeld disclaimed any special knowledge of locomotive practice, but offered his suggestions subject to further check and analysis by engineers expert in locomotive design. In other words, he presented his ideas to the specialist in steam-locomotive practice for what they were worth.

There is no doubt but that the designer of steam locomotives, like the designer of power plants for marine service, can profit from recent developments in the steam-power-plant field. The consideration of ideas and experiences from engineering fields closely allied to the railroad should go a long way toward improved perspective and lead to further progress.

Associations And Conventions

A definite movement has been developed by the American Railway Association to cause various associations of mechanical department officers and supervisors to cancel arrangements for conventions during 1931, and it has been announced that a committee of the Mechanical Division of the American Railway Association will meet with presidents and secretaries of all of the railroad associations to consider possible consolidations of the railroad conventions of the present independent associations. This brings a serious problem before the executives of these associations. On their action, as well as that of the Mechanical Division committee, depends the future welfare of the various organizations and, what is of even greater importance, the future welfare of the railroads in the various specialized fields with which the associations deal.

The attention which the holding of nine conventions during the year has attracted to the associations which deal directly or indirectly with some phase of mechanical-department operation has subjected them to considerable criticism. Most of these associations have the benefit of exhibits of equipment for use in shops or on locomotives and cars, the assembling of which, in the aggregate, involves a very considerable expenditure. These exhibits have grown up as an auxiliary of conventions of the railroad associations and the exhibitors have contributed extensively to the entertainment which forms a part of the convention programs. Whether or not the expense of holding these exhibits is justified is primarily a matter to be settled by the manufacturers of supplies and equipment who exhibit their products. In practically all cases the exhibits have developed to their present status because these manufacturers believed that the opportunity offered by a convention to reach in one place and at one time a large number of railroad men, who in one way or another influence the purchase of their equipment by the railroads, offered them an opportunity to do a job of sales promotion and educational work which could not be done as well or as cheaply in any other way.

If conditions have changed or the character of some of these associations has become such that the exhibits no longer offer such opportunities, the obvious recourse of these companies is to discontinue exhibiting. Should it be impossible for an association to hold its annual conventions were the exhibit to be discontinued, it certainly raises a serious question as to the continued usefulness of that association.

What has just been said is of general application irrespective of business conditions. Now, however, the railroads are faced with the necessity for extensive curtailments of expenses, and it is this situation which has led the American Railway Association to request the mechanical associations to discontinue the holding of their conventions, at least during the coming year, in the interest of economy.

This raises another question. Should any association have something to contribute to improvements in the effectiveness or economy of operations within the field of its activity, is it true economy to withhold meeting for the consideration of such problems at the present time? If an association does not believe that it has anything to offer which is of value to the railroads during the present situation, does it not raise a question as to the value of the association at any time?

Obviously the advisability of holding a convention at the present time, accompanied by an extensive entertainment program, is questionable, but one good test of the usefulness of an association may well be its ability to hold a productive business meeting devoid of all entertainment features.

These are questions to which the executives of the various associations must give careful consideration.

Material Delivery in Car-Repair Yards

One of the most important features of any rip track or car repair yard is the method of delivering material from the store-room or shop departments to cars which have been spotted on the various tracks for minor or extensive repairs. Obviously, no single system, however carefully and efficiently devised, can meet the needs at every car repair point. At small points where relatively few cars are undergoing repairs at any time, doubtless an expenditure for anything more than a well-maintained dirt or cinder roadway with a power-operated tractor and a limited number of trailers would not be justified. At larger repair points, however, the volume of material to be handled daily may well justify substantial investments in delivery systems. Labor is such an important element in car repair costs that every

reasonable effort must be made to conserve it at both large and small repair yards by handling material efficiently and promptly to the cars, thus saving man-hours of labor cost and, in addition, permitting the more prompt return of the cars to revenue service.

In climates subject to heavy rain and snowfall, it often becomes practically impossible to maintain ordinary roadways in condition for the satisfactory operation of truck and tractor equipment, and, frequently, this equipment is hardly able to move itself, to say nothing of dragging one or more low-wheel trailers loaded with car wheels or other heavy material. How can this problem be met?

The first solution to suggest itself would be the installation of concrete roadways, which would give a hard surface but still leave unsolved the problem of snow disposition. Moreover, car repair yards usually cover a large amount of territory and, in most cases, railroads have not felt justified in going to the expense of installing concrete roadways. As an intermediate measure, a great many yards have been equipped with narrow or standard-gage material delivery tracks between alternate tracks devoted to the repair of standard-gage equipment. Push cars of various types are generally used for the movement of material over these delivery tracks, small turntables being provided at the crossings, wherever necessary to get from one track to another. Heavy loads of lumber, wheels or other material can thus be moved readily from one point in the car-repair yard to another without danger of getting stalled in the soft ground or blocked with snow, which can be cleaned from tracks much easier than from the ordinary roadway.

The difficulty with this method is the inefficiency of employing manual labor to push cars of material about the yard, accompanied by much loss of time and delay to repair operations. The push car, when loaded with heavy material, requires the efforts of not less than three or four men to move it along the tracks and, often, a "slow motion" camera would be required to record accurately the progress of the car. As long as the car is moving, the foreman or supervisor has little recourse but to fume inwardly, for any objections he may advance are likely to be countered with the familiar expression: "We are not horses; we are going as fast as we can." And, is there not a substantial degree of merit in that contention? Everyone familiar with car-repair operations can readily bring to mind a picture of a loaded push car proceeding leisurely down the track under the efforts of a number of men who, regardless of whether they are exerting their best efforts or not, are wasting both man-hours and car-hours. It is a logical question to ask how long railroads can afford to carry on such a wasteful practice and, in this day and and age, permit men to do work better accomplished by horses or power vehicles.

The challenge of this particular railroad problem has been taken up by the Chicago & North Western and a solution proposed, as described on another page of this issue, namely, to motorize the narrow-gage material-delivery system. Experience over a period of nearly two years at three car-repair points has apparently fully demonstrated the economies anticipated from the replacement of manual labor by mechanical power for handling material. After considerable experimenting, a gasoline power-unit, operating on flanged wheels with chain drive to the rear wheels and having a four-wheel type front swivel truck, was developed. It is equipped with a carrier on the rear and can be used without trailers for the delivery of a large proportion of the small material required in repairing cars. Special trailers are, of course, provided for the handling of heavy materials such as wheels, lumber, etc. The only change necessary in the narrow-gage rail system formerly used was the installation of curves and switches in place of the turntables. One man operates the power unit, throws the light switches and handles as many as eight trailers loaded with wheels, as compared with four men formerly required for handling a single wheel trailer. In the handling of scrap trailers in a train up the inclined way provided to the scrap dock, the power unit is also as far superior to man-power that there can be no real comparison.

The motorized narrow-gage track and equipment constitute in effect a miniature transportation system superimposed on the repair yard and, with the careful and studied arrangement of tracks, gives ready access to any car in the yard. Movement of the equipment on rails instead of rough roads contributes to low operating and maintenance costs and, considering all elements of expense, including the cost of alterations in the narrow-gage track system and an ample allowance for depreciation, the North Western reports that the motorized narrow-gage material delivery system will pay for itself in a few months' operation.

Seven Years Hard Work

One of the disguised blessings of the periodical and temporary slowing down of business is the fact that circumstances force upon many people the necessity of doing some pretty solid thinking about the future. The thinkers may generally be divided into two broad classes —one that thinks that conditions such as we are experiencing are the inevitable portion of mankind and that nothing very much can be done about it except to suffer through it, and the other more constructive class that knows there is something lacking in this scheme of industry and business and is striving to find the sane and sound solution to the problems that are before them. The latter class is much too busy now to be bothered very much by hard times.

As this issue goes to press we are not only facing a new year but we are facing a new period in the business cycle—possibly even a new era in railroading. It is possible that the thousands of men in the mechanical departments of American railroads do not realize that conditions are going to turn the spotlight on them during the next few years.

It is to the mechanical department that railroad managements are going to look to discover the possibilities for greater economies in locomotive and train operation, still greater savings in car and locomotive maintenance and the wider application of sound economic principles to the management and organization of shop and engine terminal. The next few years will impose on mechanical department officers and supervisors the responsibility of spending wisely many millions of dollars, not to increase the productive capacity of railroad plants, but to effect economies in equipment maintenance.

Someone once said that "Worry is thinking without facts" and if this is true there are going to be many problems in the next few years of mechanical department operation that will cause some people a lot of worry. One of the elements that at times seems to be lacking in railroad operation is an agency which would permit the reduction of all problems to basic facts upon which could be developed a proper course of action. Mechanical-department men will be expected to find designs of locomotives that will permit more economical operation on the road at less expense for fuel and maintenance; new designs of cars that will more nearly meet

the demands exacted by changing methods of shipping and at the same time meet squarely the problem of repair shop operation so as to be in a position to know where money may be expended most effectively to reduce the locomotive-mile and car-mile cost of maintenance. Experience alone will not solve these problems and because the railroad as an industry is somewhat different from all other industries, very little help may be expected from outside sources. The only salvation seems to be to get the facts concerning the many problems and to apply these facts to the practices of the past. It may be surprising how many practices will require radical changing.

Up to a few months ago two absorbing problems were gradually forcing themselves to the front—stabilization of employment and personnel relations. The need for the solution of these two problems is probably better appreciated now than it could have been a year ago. Now is the time to look at these questions in the light of past experience, gather volumes of new facts concerning them and decide the course to take to assure the railroad industry a place as a leader in the stabilization of the business of the future.

We have had our "seven lean years" in the past twelve months and to that class of railroad mechanical men who can still view the future with confidence there appears the prospect of seven years of hard work the rewards for which will be to place the railroad industry in a position where it will be respected for the fighting, thinking industry that it should be and individually to raise the railroad man's estimation of himself and his job to a point where he will feel that he need offer no apology to any one for being a railroader. How to accomplish this is the problem. May we offer a paraphrase of the epigram "Get the facts and you won't have to worry."

The Unemployment Problem

Like the majority of other industries, the railroads are in the midst of a period of acute unemployment the basic causes of which are beyond their own control. Economists tell us that the causes lie in mal-adjustments somewhere in the chain of economic processes between the production of goods and their ultimate consumption and that, basically, these mal-adjustments arise from the mass effect of the complex and uncontrollable impulses of human nature. The solution, they say, lies in co-operation—co-operation not alone of the units in a single industry nor of all of the industries of a single country, but co-operation which is world wide in its scope and political as well as economic in character.

To those who are responsible for the management of individual units of industry, bringing about co-operation on any such gigantic scale will appear to be attended by insurmountable difficulties. So far as the immediate needs of each industry are concerned, there is no solution of the problem at all on this basis.

During the past few years many industrial corporations have undertaken the development of policies and programs for the purpose of eliminating periods of seasonal unemployment. These measures the economists, from their high vantage point of detached observation, are inclined to brand as mere palliatives—remedies which treat the minor symptoms but which do nothing to remove the causes of cyclical periods of industrial inactivity. Recognizing the vagaries of human nature, particularly as they are disclosed in buying habits, the economists are, perhaps, not to be blamed for their lack of enthusiasm for the measures which individual industries have had the temerity to develop.

The managers of industry, however, have had much experience in dealing with human problems in production and they are not so readily convinced of the hopelessness of improving the regularity of employment by the administration of their palliatives. Their experience in dealing with human nature in their employee relations has led them to believe that, while it may not be possible to effect a forced control of human impulses, measures of wise leadership may be confidently counted on to meet with a high degree of co-operation from the employees.

The railroads are a striking exemplification of the need for a wide-spread inter-industrial co-operation for anything like a complete solution of the cyclical periods of unemployment. Transportation, being a service, cannot be produced and stocked in advance of immediate requirements, and, hence, the railroads are more helpless than the producing industries, so far as their major activities are concerned, in a period of general depression like the present. But they have been no slower than other industries in attempting to stabilize employment, so far as the conditions within their own control would permit.

During recent years many roads have given serious thought to smoothing out seasonal variations in employment in their shops, and a variety of measures have been adopted to that end. During the past few weeks there have been several examples of serious efforts to ameliorate the even more difficult situation caused by the general depression. Some of the emergency measures, it is true, have been at the expense of employment in other industries. In other cases, however, by securing permission from the Interstate Commerce Commission to charge to a suspense account considerable amounts expended for maintenance of equipment not required by current use of the equipment, to be taken into the proper operating-expense accounts during a later year as the equipment is returned to service, roads have been able to provide immediate employment for many men who otherwise could not have been employed until 1931 without unduly affecting the operating ratio for 1930. While in the long run the number of man-hours of employment cannot be increased in this way, they can be so smoothed out that the hardships imposed upon the employes by the depression will be minimized. To that extent these measures are a real contribution to restoration of more nearly normal business conditions.

Let it be admitted that these measures are palliatives so far as their direct effect in preventing the recurrence of cyclical periods of unemployment is concerned. But let no one for that reason be deterred from adopting similar measures. It is only through the courage with which the managers of individual industrial and business organizations attack those phases of irregular employment which are within their own control that a beginning can be made toward any kind of co-operation which reaches beyond a single industrial organization.

As each industry learns from experience the limitations of its own unaided efforts to improve its own condition, is it too much to hope that it will become increasingly conscious of its measure of responsibility, as a consumer of their products, for the conditions of employment in other industries? May it not thus be impelled to shape its activities as a purchaser so that other industries may be aided in their efforts to solve their own problems? Is this not the first step in the evolution of that wider measure of co-operation which in itself now seems impossible of attainment?

THE READER'S PAGE

New Wheels and Oversize Wheel Seats

TO THE EDITOR:

In his article on page 639 of the November issue, W. H. Shiver discusses the use of an axle with an oversized wheel seat. I believe that most of us consider an axle with an oversized wheel seat a very valuable find, for we usually have enough slightly oversized wheel seats in our stock of second-hand cast, cast-steel and wrought-steel wheels to welcome such an axle, to keep from buying new axles to dispose of these wheels.

I should like to ask why anyone would use an axle with an oversized wheel seat for new wheels when the A. R. A. rules permit a variable dimension of from 6¾ in. to 7 in. on new wheels and also on the use of wrought-steel wheels of 60,000 lb. and 80,000 lb. capacity bored to larger size. Why bore them to fit an oversized wheel seat when the same variable dimensions of from 6¾ in. to 7 in. may be used, thus saving a waste of metal from the core, and axles with wheel seats of these sizes can always be secured from stock?

A. F. TARPLEY.

Loose Wheels—A Reply

NEW HAVEN, CONN.

TO THE EDITOR:

In reply to "A Reader's" letter to the editor which appeared in the August issue in which he asked the question, "Does a wheel have to move on the axle after it has been removed from under the car as proof that the wheel is loose, or is there a possibility of it being sufficiently tight on the axle to deceive the car repairman?"

A loose wheel is a rare defect. However, wheels with indications of looseness are quite common, and oil seepage is the most common indication found. In some cases steel dust will show up when the wheel is decidedly loose.

A. R. A. Rule 81 states that the owners are responsible for wheels removed account of being loose. The same responsibility applies to wheels removed from service on account of indications of the wheel being loose, such as oil seepage from the inside of the wheel fit. There are many wheels removed from service on account of oil seepage. But frequently, when these wheels are placed on the press, they will show proper pressure in the fit. This condition, however, should not prevent car inspectors from removing wheels from service when oil seepage is visible, as this is the only indication that can be used to remove these potential hazards from service.

Oil seepage is a defect that can be eliminated if the wheel is not actually loose. Wheel shops are usually to blame for this condition. A poor mixture of coating for the wheel seats, an improper bore, a bore with ridges or chatter marks, which may be made when removing the boring bar. A longitudinal seam in the wheel seat might allow the oil to seep through and give false indications of being loose.

The most common practice in a wheel shop which will cause oil seepage is to make an improper coating mixture. The A.R.A. Committee on wheels recommends a white-lead mixture with boiled linseed oil, 12½ lb. of lead to a gallon of oil, thoroughly mixed. Most wheel shops adhere to this practice but use a lubricating oil or raw linseed to thin the coating down after it has been used for a day or so subsequent to the time of mixture. The lubricating oil will not dry and will show as oil seepage as it has a tendency to work out from the fit after the wheel has been in service. The most common practice used to determine a loose wheel is to chalk the axle at the wheel seat and inside of the wheel plate and roll the wheel up against another pair of wheels. The shock will have a tendency to move the loose wheel around the axle. If the wheel moves it will break the chalk line.

A good practice followed by some wheel shops is to place a mark in white lead on the axle and inside the wheel plate. This mark, of course, is not visible after the wheel has been in service for a considerable length of time, but if any improper condition should exist to allow oil seepage, the fact that the mark does not coincide at the fit will show whether or not the wheel is loose on the axle. This is one of the best methods used for quick inspection of wheels for looseness. If this practice or some similar standard practice were used it would eliminate the unnecessary removal of many wheels because of oil seepage. Until some method is developed to give car inspectors some accurate method to determine whether or not wheels are loose the wheels should be removed when any indications are shown.

J. W. McDONNELL.

Make Foreman's Jobs Attractive

TO THE EDITOR:

The October issue of the *Railway Mechanical Engineer* runs an editorial on "The Foreman's Wages," of which I wish to express my sincere appreciation. I have wondered in times past why some one did not foster an improvement in conditions particularly affecting the enginehouse foreman. Although not employed at an enginehouse or in a supervisory position of any kind on the railroads, I have come in contact with many of the minor supervisors and find that in the great majority of cases they are skilled in their line, fully capable of their duties and, generally speaking, working for much less per hour than many of the men under them, when one stops to consider the long tour of duty and the fact that they are subject to call at practically any hour of the day or night.

I am particularly acquainted with one of the larger railroad's practice in fostering the special apprentice course, the graduates of which usually fall heir to an enginehouse job for at least a couple of years of their training. I believe that a certain amount of enginehouse work is essential to their advancement but nothing can destroy a sense of advancement as rapidly as to hold down a gang leader's job in an enginehouse for an indefinite period.

These special apprentices, usually college graduates,

aline themselves with the railroad with the thought and hope of an official position. They start in at a rate much less than paid to many college graduates in other industries and struggle along on rather meager wages for a three-year period to wind up their apprenticeship as inspectors, or enginehouse gang leaders, etc. Surely it is not the intention of the railroads to lose the training that they have worked so hard to give these young men, but with the field of advancement so seemingly occupied by men with more seniority, etc., there seems to be but little opportunity for these men to advance. Therefore, they seek elsewhere for positions and I know that this particular railroad has lost a number of high type men who would have become splendid officers simply because the railroad would not, or could not, advance them and pay them wages somewhat on a par with those paid for the same ability and effort in other industries.

Your editorial on foreman's wages is timely indeed.

B. CHARLES.

A Reader Comments On Standard Cars

TO THE EDITOR:

I note with some interest that the editorial on page 635 of the November *Railway Mechanical Engineer*, with reference to the recent address made by T. C. Powell, president, Chicago & Eastern Illinois, before the Car Department Officers' Association convention at Detroit, Mich., infers that the traffic department and the shippers are primarily responsible for the condition to which Mr. Powell objects.

There is no good reason why shippers should not expect a container for their shipments which permits the economical loading of that shipment. Neither is there any reason why, with the large variety of commodities that can be loaded in a certain uniform size car, such cars should not be developed. The shippers would doubtless be glad to co-operate with the roads to this extent.

The railroads are in a poor position to make any complaint against the shippers' demand for various types of cars until their own engineers are able to agree on some uniform type of car construction.

The American Railroad Association has a Car Construction Sub-Committee which is in session more or less continuously and which is supposed to develop recommended standards for car construction. Apparently this committee gives more attention to the strictly engineering details of the problem than to the practical application of the finished product. Mr. Powell's address indicates that the railroads think but little of the committee's recommendations for standard cars inasmuch as the number of standard cars built decreased from 23 per cent of the total box cars in 1926 to about 2 per cent of the total box cars built in 1930.

The small number of standard cars actually built indicates that the individual railroads are unable profitably to use the so-called standard car and must develop their own type of car—a car which will meet the demands of that road's shippers.

Before placing the blame for use or demand of non-standard cars on the traffic department, can it be said that the Mechanical Division committee has made a survey of the car demand situation with a view to designing a standard car that will suit the majority of shippers? This does not seem to be the case. Apparently the committee designs a car which is suitable from an engineering and maintenance standpoint and lets it go at that. The surprising feature is that the officers of most of the railroads involved approve the recommended standards, knowing full well that they are unsuitable and that they would not consider the purchase of such a standard.

Why blame the traffic department for being unable to predict the type of car that will be demanded when they must contend with the requirements of many shippers who in turn have the experience of trying to make their lading conform to the area, design and cubical capacity of hundreds of different types of cars, many of which were designed quite a while before the shipper became so rigid in his demand for a particular type of car?

There will always be a demand for a certain number of odd-size cars for unusual lading but it certainly appears that, if the car designers pay more attention to the problems of the traffic department and less to the convenience of the car builder and maintainer, it will be possible to work out a standard car that will increase in demand as time passes rather than decrease in the manner that the so-called present standard car has, as indicated by the lowering percentage of standard cars being built.

Traffic is the life-blood of the railroad and there should be no foundation for complaints on shippers' demands for economical containers when consideration is given to the fact that the railroads themselves have the answer to the problem in their own hands in that they could design a series of uniform containers or cars for the various groups of lading which would be economical both to the shipper and the railroad.

A wonderful opportunity has been overlooked in the past few years to complete the development of uniform equipment. The thousands of wooden cars, which were of many designs, were retired from service and could have been replaced with uniform equipment but unfortunately this was not done and the ancient method of each road following its own nose was continued with the result that the situation remains the same with the steel equipment as it was with the wood equipment.

It behooves the car designers to wake up and discover that, while the engineering is important, traffic and the satisfaction of the shipper is more important and that no type of car will ever be standard that is not designed to suit the shippers' convenience.

R. R. HOWARTH.

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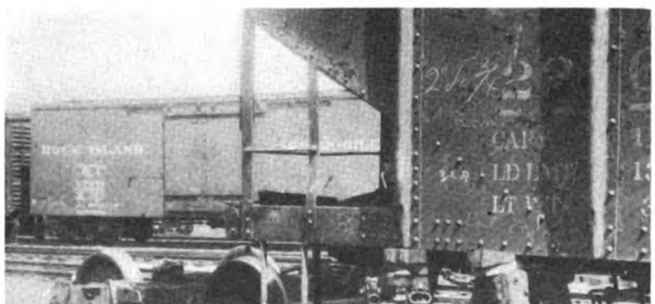


An illustration of safe practice in jacking and supporting a car body

With the
Car Foremen and Inspectors

Proviso Hump Yard Car-Repair Facilities

THE Chicago & North Western hump-yard repair tracks, located at Proviso, Ill., has a capacity of 110 cars, with a daily output under ordinary conditions of about 75 cars, employing a force of 40 men. This car repair yard located at the foot of the hump classification yard is operated for the purpose of making medium and light repairs to all loaded and empty bad-order cars received off the road from the Galena and Wisconsin Divisions. Cars are inspected at the receiving yard, and any cars found in bad order are switched over the hump and to a specially designated bad-order track. They are then spotted on the hump repair track. Heavy repair cars are switched to a separate repair yard of 500-car capacity, located adjacent to the forwarding yard.

The proximity of the medium and light repair yard to the Proviso Hump Yard permits rush loads of perishables or other commodities being immediately spotted, repaired and returned to the classification yard for forwarding without unnecessary delay. All loaded cars, and empty system and foreign bad orders are repaired on the same date spotted, the car-repair force being balanced to accomplish this result.

The buildings at the car-repair yard are constructed of tile, being fireproof throughout, and equipped with electric lights, washing facilities, modern conveniences, etc. These buildings occupy the center of the repair track area, making them readily accessible from all parts of the yard. They comprise the following units: Lumber shed, paint shop, steel car repairers' room, air-brake room, air-brake repairers' room, mess room, lavatory, car foremen's office, store-department office, blacksmith shop, oil house casting platform, wheel bed, elevated scrap dock and incinerator. The buildings were designed as a result of experience with two former repair yards, and the arrangement of all buildings and units have been found to fit the needs without change from the original layout.

The lumber shed is of special design required for the protection of a limited stock of lumber used in repairing freight cars. The steel-car repairers' room is equipped with tools and facilities for handling this phase of the work. In the air-brake room, triple valves are repaired and tested, angle cocks ground and similar work handled. The air-brake repairers' room is equipped with modern facilities for performing air-brake work.

Comfortable Quarters Provided for Car Men

A feature of the repair track is the provision of commodious, comfortable and well-lighted quarters for the car-repair forces. The mess room is equipped with benches and tables, lockers, a water fountain and lavatory and is kept clean and warm at all times.

The car foremen's office is located centrally with respect to the buildings in the repair yard, the stores department office being adjacent to it. The store-department building is divided into two sections, one containing the office and storage for small materials, and the other unheated section for rough castings.

A modern blacksmith shop, adequate for all operations commonly encountered in light repair work, is equipped with a power-driven drill, grinder and pneumatic hammer, in addition to the forge. Neatness is also a notable feature of this shop.

Motorized narrow-gage train delivering material at the North Western car repair yard, Proviso, Ill.

The packing renovating plant is completely arranged for the receipt and distribution of packing without the necessity of the journal-box packers going inside. The packing is received through an opening with a sliding door just over the receiving tank and is distributed as required through a chute to the packer wheelbarrow. Complete facilities in this house are provided for renovating packing and filtering oil.

An outdoor casting platform is provided for the storage of couplers and larger material not appreciably harmed by exposure to the weather. A wheel bed, with a capacity for 300 pairs of second-hand and new wheels is arranged as illustrated, the wheels being separated according to size and kind. Air cranes for loading and unloading these wheels are provided, as all wheels are received or shipped in gondolas or flat cars, double decked. This is a feature of North Western operation which contributes much to economy, all rip tracks and car repair points on the system being equipped for doubledeck loading.

The scrap dock, located on an elevated platform, is partitioned off for the different classes of castings and scrap, which greatly facilities the handling of material and loading of scrap on cars.

One of the most important features on the repair yard from the point of view of contributing to neatness and a generally picked-up condition is the incinerator, made of a scrap locomotive boiler mounted on a brick base and in which all refuse is disposed of by burning. A sheet metal door covers the firebox opening and serves for the admission of the scrap wood and material, at the same time controlling the draft. A screen in the top prevents the emission of any sparks large enough to cause a fire hazard.

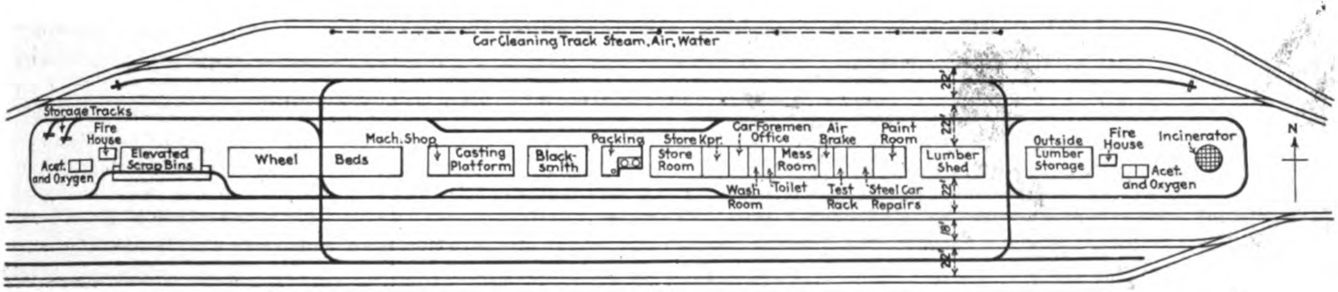
The influence of order and cleanliness is not only evident in the increased efficiency of the repair track but in the greater safety of operation. Work has been carried on at this point for the past eighteen months with only one reportable injury.

Adjacent to the hump yard is a freight-car cleaning track equipped with steam, air, water and drainage and having a capacity for cleaning 50 cars a day. The location of the cleaning track is particularly advantageous in the interests of prompt car movement, because certain repair work, such as renewing flooring, sheathing and minor operations can be performed on the cleaning track under protection, eliminating the necessity of extra switching. Cars are cleaned at this point for all kinds of commodities and commodity cards applied to indicate the loading for which each car is suited.

Motorized Narrow-Gage Material-Delivery System

One of the most novel and interesting features of the hump yard repair track is the motorized narrow-gage material-delivery system which has been in service long enough to demonstrate marked flexibility, economy and adaptability to this kind of work. Referring to the drawing, it will be noted that a track system of 24-in. gage permits delivering material to a car in any part of the yard. The main track of the system completely encircles the buildings, side tracks or turnout tracks making it possible to load heavy material from certain departments, such as the blacksmith shop, casting platform or storeroom, directly onto trailers. An outer belt track connects with the wheel bed, making possible the loading of wheels and their delivery to any point in the yard with little effort and no delay. Extensions of the narrow-gage system also reach to the elevated scrap platform at the west end of the plant and to the incinerator at the east end.

The power unit consists of a Model A. Ford, adapted by the North Western Motor Company, Eau Claire, Wis., to operate on flanged wheels with a front four-wheel swivel truck and power furnished by chain and sprocket drive to the rear wheels. A special chassis was designed with a driver's cross seat in front and a carrier in back for holding couplers, brake cylinders, triple valves, air hose and similar relatively light material which constitutes approximately 80 per cent of the delivery requirements of this rip track. The power unit, therefore, serves not only as a tractor for hauling trailers, but is, in itself, a material supply car which handles a large proportion of the material directly from the store-room or shop to the car. The power unit is sup-

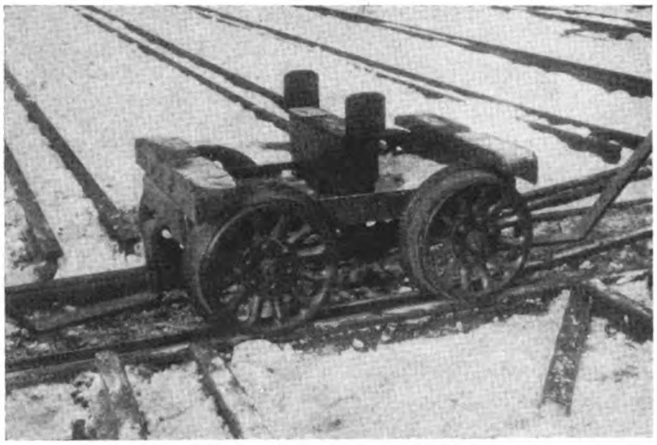


Arrangement of 24-in. narrow-gage track system used for delivering material at Proviso car-repair yard

Old locomotive boiler used as an incinerator

plied with a special brake equipment, as well as sand pipes for use under unfavorable rail conditions. Roller bearings are provided throughout and the unit is fitted with couplers which may be easily engaged.

Trailers for handling heavy material include in general only three types: A special trailer for handling wheels, a pair of wheel trailers with special bolster equipment for handling lumber, and a trailer car for handling scrap material and refuse. The wheel trailer is clearly shown in one of the illustrations and comprises a four-wheel unit with cross-bearers arranged at



Close-up view of the special car-wheel trailer with removable swivel bolster temporarily applied for handling long lumber

the proper height so that wheels can be rolled along the rail and up on the trailer with very little physical effort.

The special bolsters used on the car-wheel trailers for handling lumber are shown in another of the illustrations and can be readily designed to handle wider and higher loads of lumber, if necessary. The trailer car is in reality a triple combination car which has an ingenious arrangement of adjustable and removable side boards, facilitating its use as a box, low-side gondola or flat car. In practice, it is seldom found necessary to remove the sides entirely.

Savings Up To 250 Per Cent Per Annum Secured

The motorized narrow-gage material-delivery system is now installed at three points on the Chicago & North Western and experience has shown savings as high as 250 per cent on the moderate investment required in narrow-gage track and equipment. Where the tracks are already installed the only expense required in "permanent way" is for replacing the turntables, customarily used, by necessary curves and switches.

The principal advantage of this delivery system is that it gets material where it is needed, quickly and regardless of wind, weather, or ground conditions often making it practically impossible to operate truck and tractor equipment. Work and car delays chargeable to slow delivery of material are therefore largely avoided.

The most important single item of savings is the reduction in labor. Where three or four men were formerly required to roll a pair of wheels on a special trailer and push it from the wheel bed to the car, one man, operating the power unit, can take as many as eight pairs of wheels at one time from the wheel bed to any point in the repair yard in a fraction of the time formerly required. The possibilities of savings in time and cost of delivery of small materials, scrap, rubbish, etc, are also large. At one point, requiring the use of two power units it was found that necessary material could be delivered to the cars, scrap dock, incinerator, etc. with a saving of the labor of three carmen helpers and two laborers, or $5046 a year.

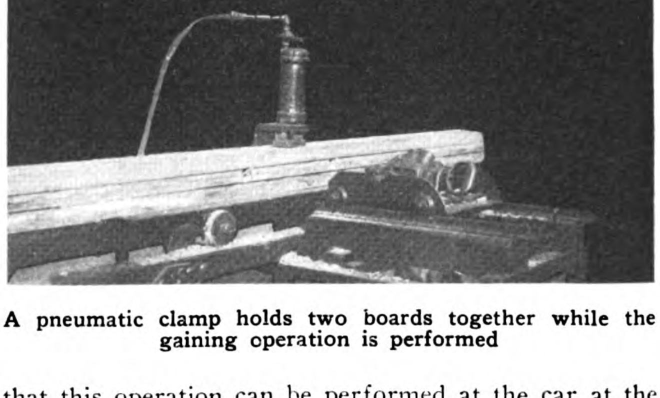
The operating expense for gasoline, oil, etc., is small, owing largely to the fact that heavy loads can be hauled on steel rails with relatively little tractive force as compared with movement over dirt or even concrete roads. The total operating expense, exclusive of labor, of the two cars mentioned, was only $310 for a period of one year.

Maintenance costs likewise are low and for a similar reason. With power equipment operating on rails, there is far less vibration, rough usage and actual abuse such as encountered when this equipment is used over dirt or cinder roads which are always relatively rough under the best of conditions and, when rendered soft by excessive rains or covered with snow, are often nearly impassible. The fact that maximum power of the motor is seldom required also contributes to long life of the equipment. Accurate records of all details of maintenance costs on the two power units already referred to show a total of only $125 a year.

The increased speed of operation, in addition to other advantages reduces the amount of power and trailer equipment required. At the Proviso hump repair yard, two power units are more than enough to take care of the requirements and the number of trailers in regular use is reduced 50 per cent. The aggregate saving from any material-delivery system is more or less proportional to the volume of material to be handled. Under the conditions at the hump repair yard, charging 6 per cent on the investment and the ultra conservative depreciation of 20 per cent, annual savings up to 250 per cent are being earned on the investment in narrow-gage track and material-handling equipment.

Gaining Out Freight-Car Flooring

THERE are many methods in use for gaining out freight car flooring to provide clearance between the flooring boards and the rivets on the center-sill cover plates, especially on gondola cars. While it is true



A pneumatic clamp holds two boards together while the gaining operation is performed

that this operation can be performed at the car at the time the flooring is being applied by using a sharp-edged tool or by providing the mechanic with an air motor, it

has been found more economical to have this work done prior to the time the flooring is delivered at the car.

A device for performing the work is shown in the illustration. It consists of a carriage on which two flooring boards are laid and clamped together with an air cylinder to prevent the boards from moving. An ordinary wood boring motor is mounted on an adjacent carriage, the point of the wood bit being directed between the two boards so as to form a half-circle hole in each board.

Not only is this device efficient but it eliminates the possibility of weakening the flooring boards by reason of too much material being cut out in the gaining operation and will assure the boards being gained out uniformly throughout the car and permit them to be nailed securely to the nailing sills.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Billing on Authority of Defect Cards

Northern Pacific car 5817 moved from the Chicago Great Western to the Great Northern through the Minnesota Transfer at the Twin Cities on October 2, 1928, at which time a defect card was issued against the C.G.W. which read as follows: "Two side planks removed (2 by 4 by 21 ft. 6 in. A. L.), 12⅝-in. by 3-in. bolts removed, two side planks removed (2 by 4 by 21 ft. by 6 in. B.R.), 12⅝-in. by 3-in. bolts removed. Planks removed for ventilation and placed inside the car. Labor only." The Northern Pacific repaired the car and billed the C.G.W. for both labor and material, stating that, when the car was returned home, the planks had been removed, making it necessary to furnish new material for repairs. It contended that the placing of the planks inside the car was done entirely at the risk of the carding road and that there is no authority under the interchange rules for marking the card "Labor Only".

The C.G.W. stated that the planks had been removed by stockmen for ventilation purposes during the movement of show stock and that when the car left its rails the side planks in question were inside the car. It contended that the case would not come under the fifth paragraph of Rule 32 since there was no evidence that the planks were damaged or mutilated in any way. For this reason, it further contended that the entire charge for labor or material was improper and that the defect card in question should be canceled. The C.G.W. stated, however, that if the defect in question is cardable the charge should be confined to labor only.

The decision rendered by the Arbitration Committee follows: "Removing parts of car as was done in this case and for the purpose stated, is a delivering company's defect within the intent of fifth paragraph of Rule 32. If defect card in question did not provide full protection, car should have been refused at the interchange point until protection was complete. The defect card as issued is, therefore, authority only for the labor charge."—*Case No. 1649—Northern Pacific vs. Chicago Great Western.*

Joint Evidence Final in Wrong Repairs Case

On September 4, 1928, the Skelly Oil Company tank car No. 1484, equipped with 80,000-lb. capacity trucks, was repaired by the Chicago, St. Paul, Minneapolis & Omaha at its Sioux City shop. Among the repairs made were four new 1⅛-in. by 16-in. box bolts applied at R-2 and L-2. Joint evidence was obtained by the car owner at Eldorado, Kan., on December 1, 1928, showing that two 1⅛-in. by 17-in. box bolts were standard equipment on the car at R-2 instead of the 1⅛-in. by 16-in. box bolts as applied by the repairing line. The repairing line stated that the 1⅛-in. by 16-in. box bolts were fitted with one unit nut of the combination holding and lock-nut type and contended that such repairs were equivalent to the 1⅛-in. by 17-in. box bolts fitted with two common holding nuts. The owner referred to that portion of the report on car construction contained in circular No. DV 640 dealing with 80,000-lb. capacity trucks. It pointed out that the report showed 17¼-in. and 17¾-in. box bolts equipped with common nuts and lock nuts as standard equipment on 80,000-lb. capacity trucks and that no provision was made for optional use of combination holding and locking nuts with 16-in. bolts when the car owner's standard is 17-in. bolts.

The decision as rendered by the committee is as follows: "The joint evidence is final. Claim of the Skelly Oil Company is sustained."—*Case No. 1647—Skelly Oil Company vs. Chicago, St. Paul, Minneapolis and Omaha.*

Car Damaged in Switching

On March 25, 1929, Atlanta, Birmingham & Coast flat car No. 9011 was damaged in the East Thomas yards of the St. Louis-San Francisco. On March 26, the car owner, upon request, furnished the depreciated value of the car. On April 4, the Frisco advised the car owner that after a subsequent investigation it developed that the car had not been subjected to any unfair usage as defined in A. R. A. Rule 32, but had failed in fair service. As a result of this investigation, the Frisco requested disposition of the car under Rule 120. The car was dismantled on May 28, when disposition as required by Rule 120 was not furnished within 30 days, the Frisco contending that the matter was handled strictly in line with Interpretation 3 of A. R. A. Rule 120.

The A. B. & C. contended that the car was improperly handled in switching and that it was not subjected to fair usage. The owner further contended that the car was damaged in accordance with A. R. A. Rule 44 and maintained that the investigation of the incident by the Frisco did not show conclusively when or how the damage occurred. The owner also brought out the fact that the East St. Louis Junction car No. 5007 was damaged at the same time and contended that this indicated that its own car was unfairly used.

In rendering its decision, the Arbitration Committee stated that "The evidence is not conclusive that car was

subjected to any of the unfair conditions of Rule 32. Car owner did not within the time limit furnish disposition of this car under the requirements of Rule 120. Owner is responsible. The decision in this case has no bearing on the question of responsibility for damage to E. S. L. J. car 5007."—*Case No. 1648--St. Louis-San Francisco vs. Atlanta, Birmingham and Coast.*

Classification of Cars

On July 11, 1929 the Mobile & Ohio notified the Nashville, Chattanooga & St. Louis that the N.C. & St. L. car 32862 was destroyed in switch movement. The M. & O. requested the N.C. & St. L. to furnish a statement covering the depreciated value of the car. This statement was furnished by the N.C. & St. L. It showed that the car was a 60,000-lb. capacity all-wood gondola, class E4 and built or rebuilt on April 12, 1899, and that the depreciated value of the car was placed at $237.40.

The M. & O. admitted responsibility for the damage to the car but, contended that it was a class F car instead of a class E4 car. The M. & O. based its contention on the fact that the car was originally built some time during 1880 and was still equipped with wooden body bolsters, wood truck bolsters, wood spring planks and a built-up draft arm which had no direct connection whatever with the body bolster. The M. & O. pointed out the fact that it wished to establish a criterion, definitely settling the classification of these cars in order to avoid future controversy, since the N.C. & St. L. had 457 cars of the same series.

The N.C. & St. L. furnished prints showing that the draft arms were secured vertically by five ⅞-in. by 11½-in. bolts and laterally by nine ¾-in. by 6½-in. bolts. It pointed out the fact that the draft arms extended more than 24 in. beyond the center line of the body bolster and contended that the body bolster was of sufficient strength to transmit buffing and pulling shocks to all longitudinal sills.

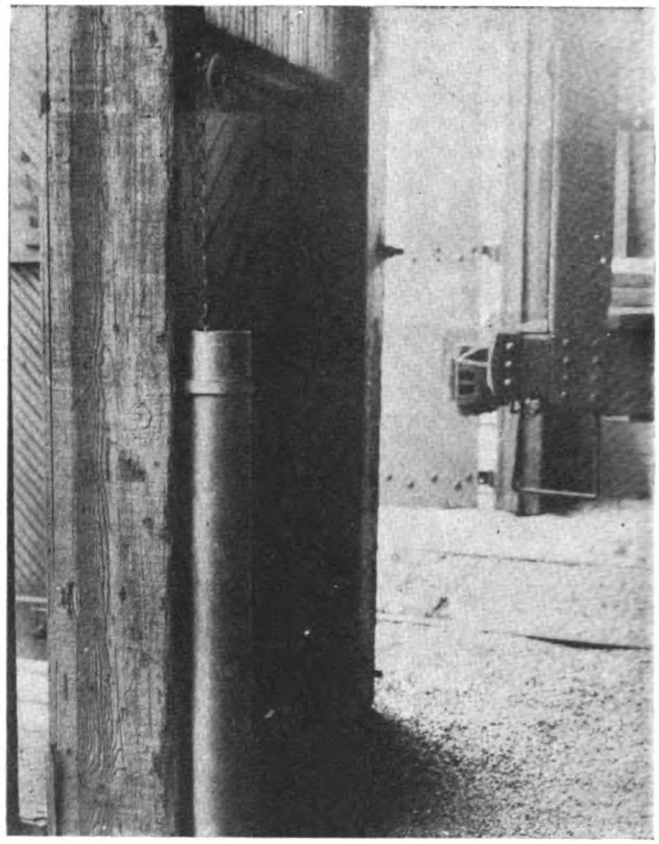
The following is the decision of the Arbitration Committee: "The car in question properly comes under class F and should be settled for accordingly."—*Case No. 1650—Mobile & Ohio vs. Nashville, Chattanooga & St. Louis.*

Closing the Car Shop Doors

IT has been said that there are more ingenious devices used in and about a car repair shop than anywhere else on a railroad. If a carman elects to make a pneumatic punch or press he merely hunts up a brake cylinder and in no time at all he has a device with all of the ear-marks of a machine. If he wants to make a delivery wagon he usually takes possession of a section foreman's push truck, burns the flanges off the wheels, shortens up an axle and a wagon comes into being (provided of course that the section foreman does not catch him in the act or the job has not progressed too far to save the push truck).

If there is a door to which some self-closing arrangement has been installed invariably it will be found that a brake chain sheeve wheel has been suspended from the hinged side of the door jam. A section of hand brake chain attached to the top of the door, descending through the sheeve wheel and to which is attached a couple of truck springs, a coupler knuckle or four or five follower plates and perhaps a few knuckle pins serve to provide the weight required to keep the door closed automatically.

The illustration, while still adhering to the brake



A scrap superheater flue furnishes the guard for the door-closing weights

chain and sheeve wheel shows the added feature of a section of superheater unit through which the weights are carried. The story is told that the addition of the superheater unit was brought about by a coupler knuckle, which was wired to the end of the chain, dropping off and painfully injuring the foot of a carman. Again a carman's ingenuity was responsible for bringing the door closing operation up to a higher degree of efficiency, a safety hazard being eliminated.

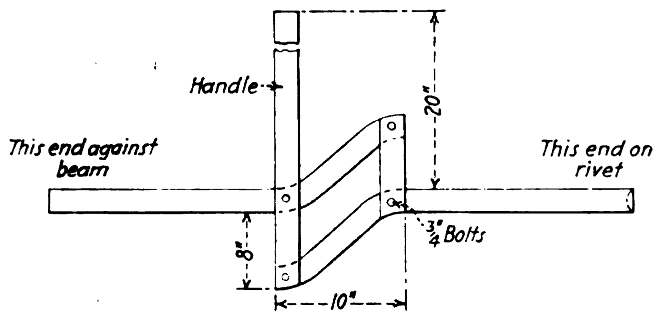
Bucking Bar For Rivets

IN the illustration is shown a bucking bar designed as a pantograph in order to be more effective in cinching rivets tightly and in speeding up production riveting. The bar gives the operator a leverage which is not obtainable in a straight type of bucking bar. It prevents vibration and enables the operator to keep the bar in line with the rivet.

The bar illustrated is made of 2-in. round steel, the ends being of any desirable length necessary for the particular conditions surrounding the work which is to be performed. As shown, it is designed to buck ⅝-in.

rivets, the dimensions of the pantograph being correct for the 2 in. bar. A bar of this style can be used effectively on construction and repair work by placing the back end against a beam or block and the other end over the head of the rivet, manipulation being affected by operating the handle. The pressure which can be exerted with the handle by the operator is sufficient to hold a rivet securely while it is being driven. It has been found to be exceptionally well adapted to the bucking of rivets in steel cars, as well as in boilers and locomotive tenders.

The bar as shown allows for a considerable amount of variation in the distance from the rivet to the support. If it is desirable to extend the end of the bar in order to reach a support, a 2 in. pipe of the necessary length can be placed over the end. The pipe should be plugged to within 6 in. of the end in order to allow it to slip over the end of the bucking bar that distance.



Pantograph bucking bar for production riveting

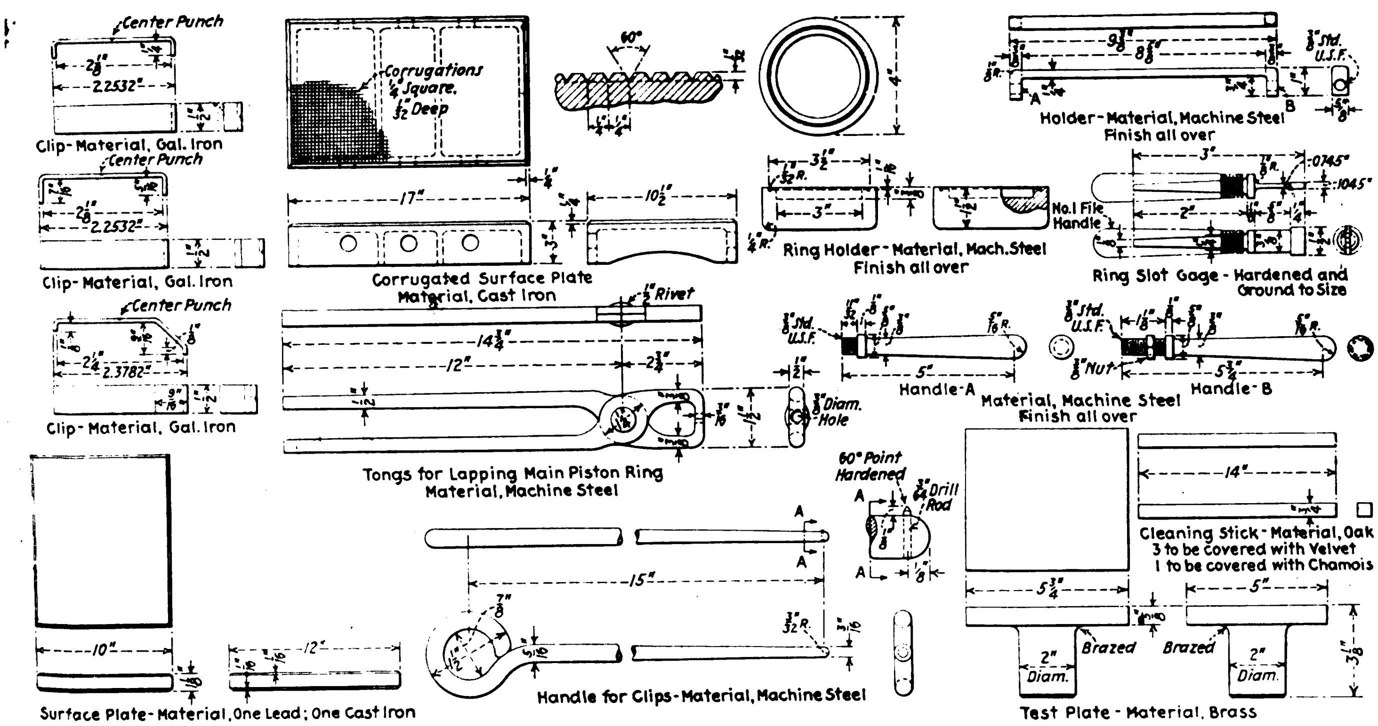
Tools for Repairing Triple Valves

THE tools shown in the drawing have been developed by the air-brake department of an eastern road to expedite the making of repairs to triple valves. Time studies made on jobs where these tools are used in conjunction with a repair stand and standard test rack allow 2 min. 22 sec. for removing the graduating stem nut, cylinder cap, and graduating spring and stem, clean and replace the graduating stem and spring, and to remove the piston; 2 min. 55 sec. to remove the emergency portion; 2 min. 51 sec. to replace the emergency valve, rubber seat and test; 2 min. 3 sec. to remove the exhaust plug, clean the bushings and blow out the valve body; 1 min. 2 sec. to remove the slide and graduating valves from the piston; 5 min. 43 sec. to clean the slide valve and seat, and graduating valves and 2 min. to true the cylinder bushings and gage the piston ring groove. Fifteen seconds are allowed to adjust the ring, and 2 min. 30 sec. for fitting the ring to the piston groove. The time required to assemble the slide and graduating valve to the piston, lubricate and apply, is 1 min. 56 sec. The cylinder cap is applied in 2 min. 10 sec.; grinding the check valve and blowing out the check valve case, 2 min. 27 sec.; assembling the emergency portion, 4 min. 2 sec.; tightening the graduating stem nut, applying the exhaust plug, removing the triple valve from the stand, stenciling and applying, and releasing the retarding device, 1 min. 35 sec. The complete job of repairing and testing triple valves can be handled in the air brake department of this road in about 34 min. A description of the triple valve repair stand referred to will appear in a later issue.

The test plate, surface plate, and corrugated surface plate, are finished all over. The lead surface plate is used to true slide valves and the cast-iron plate is used to lap rings.

The lead plate is loaded with No. 120 Aloxite or No. 120 carborundum grit which is worked well into the lead with a brass plate. A brass plate is used to true the face of the lead plate when necessary.

The cast-iron plate is used to lap rings. A piece of No. 80 Aloxite or carborundum cloth is glued to each surface of the plate with McCormick's glue or water glass. This is done by applying a thin coat of glue to the cloth and over the surface of the plate. The cloth is then spread over the plate and placed between two

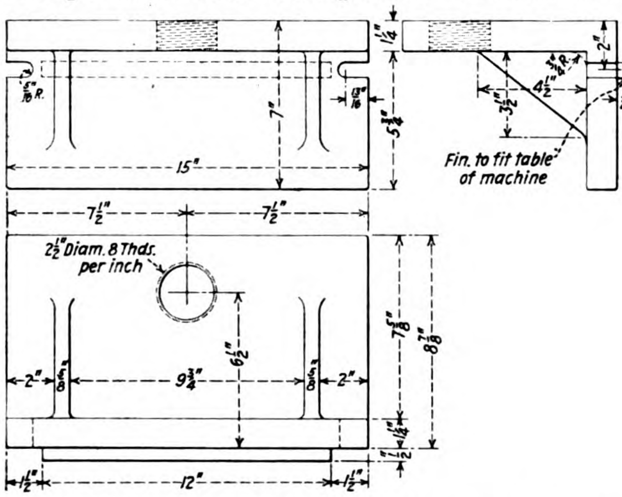


Tools which expedite the making of repairs to triple valves

boards. The boards are pressed together by clamps or weights placed on the top board while the glue is setting. The lapping plate is then allowed to dry over night. It should be kept in a box provided with a cover when not in use.

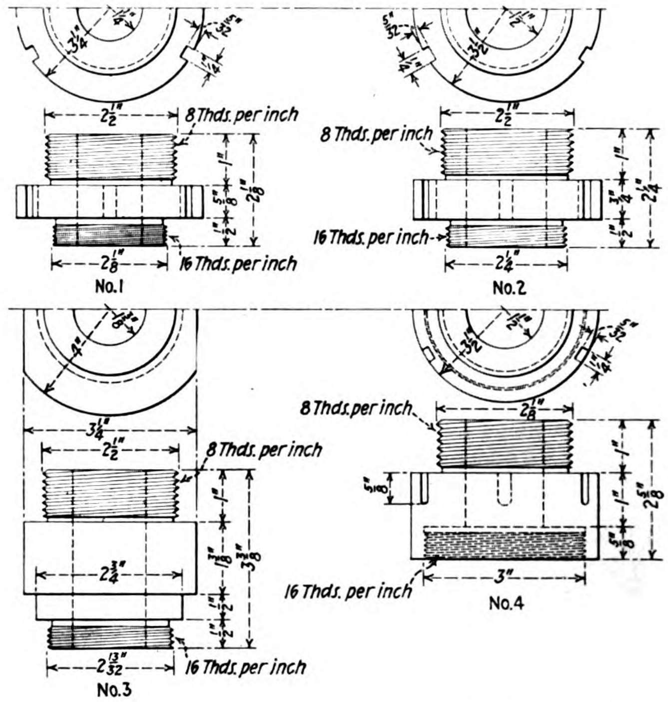
Grinding Air-Brake Parts

SHOWN in the two drawings are four fixtures and an angle plate which have been especially designed for grinding the gasket fits and other finished surfaces of triple valves on a Heald grinder. The four fixtures



Angle plate in which the fixtures for grinding triple valves are secured

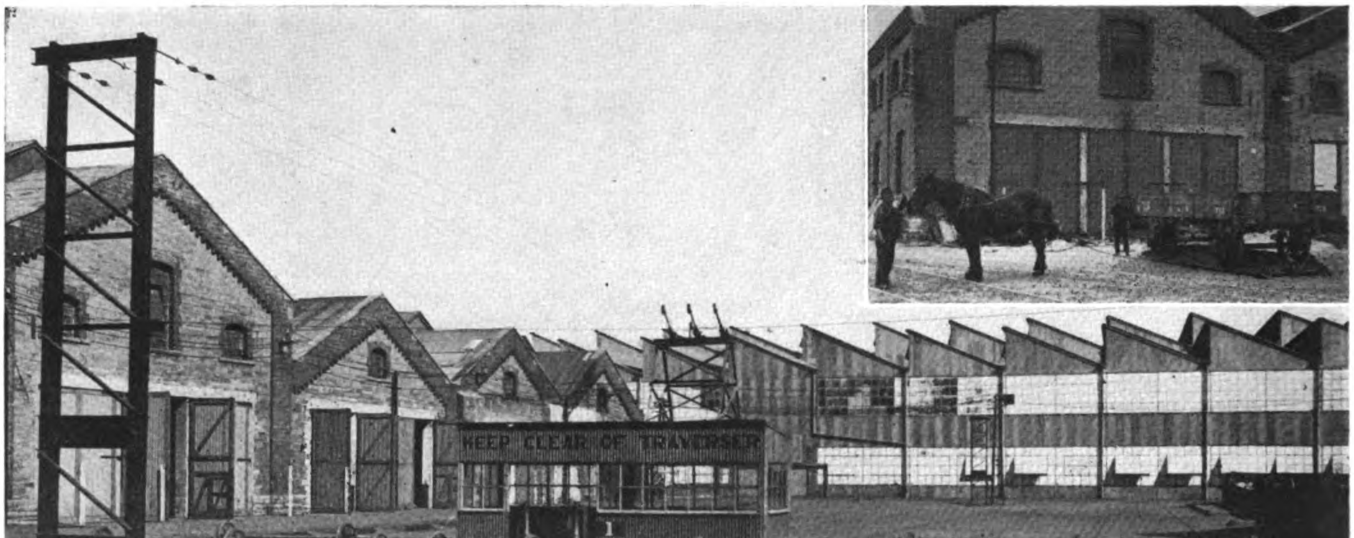
are made of machine steel with notches around the circumference to take a spanner wrench. These fixtures are screwed into the 2½-in. hole in the center of the vertical leg of the angle plate which is made of cast iron.



Fixtures for grinding triple valves on a Heald grinder

Referring to the drawing showing the four fixtures; the first fixture is used for F-25 triple valves, the second fixture is for F-46 triple valves and the third fixture for K-2 type triple valves. The fourth fixture can be used for F-29, F-27, K-1, F-36, H-49, F-1-NY, and H-1-NY triple valves.

* * *



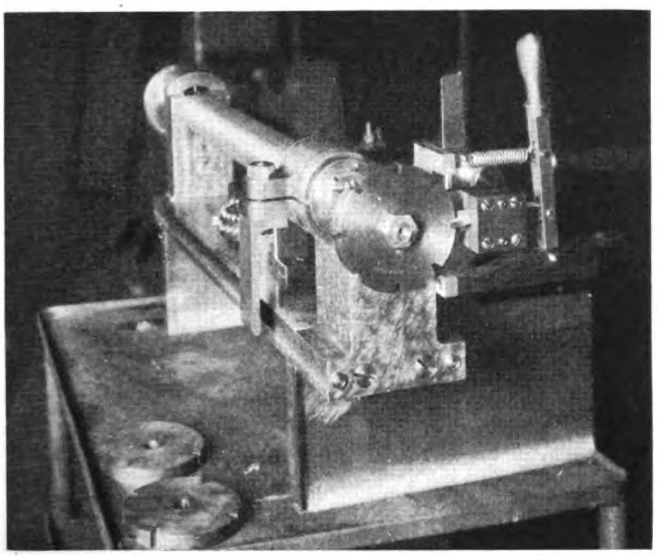
The old and the new in transfer tables at the Islington shops of the South Australian Railways—Cars similar to one shown in inset are now entirely replaced by modern 30, 40 and 50 ton cars

In the

Back Shop and Enginehouse

Graduating Special Rules and Gages

THE demand for graduating gages and other tools required in the several departments of a railroad shop for the maintenance of equipment and tools has brought about no little study, and after going carefully into the subject, the graduating machine*, operated by hand power, was developed at the Roanoke (Va.) shops of the Norfolk & Western. The machine has been perfected and improved with a view of securing as near 100 per cent efficiency as possible. The accompanying illustrations will give the reader a good idea of its construction.



Another view of the graduating machine showing the construction from the dividing disc end

This machine is built on a steel plate, 1⅜ in. thick by 11½ in. wide by 18½ in. long, and is supported by two steel parallels, 5 in. high. It has a bearing bracket on either side, 1½ in. thick and 4⅛ in. from the top of the plate to the center of the bearing. These brackets carry the lead screw, which is 2 in. in diameter and has four-pitch Acme threads.

The screw is carried in two hardened and ground split tool-steel bushings. The right-hand bearing has a ball thrust bearing on both sides of the bracket, and the end of the lead screw has a fine thread, with a lock nut, so as to eliminate any end play. Over this is a housing, marked with a zero, for the graduated ring, which is carried on the hand wheel, and reads in thousandths of an inch. On the left end is the dividing disc, of which there are three; one with two notches, used for graduating in one-eighths, one with four notches, for graduating in sixteenths, and one with eight notches, used for graduating in thirty-seconds.

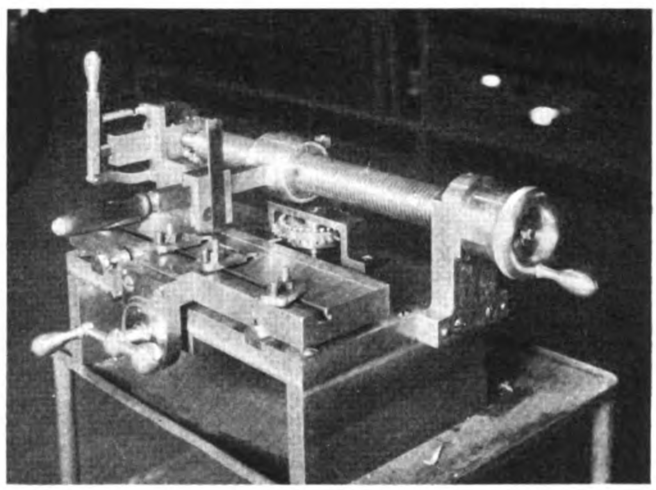
The discs are made of tool steel, hardened and ground, ½ in. thick by 4 in. in diameter. The notches are 5/16 in. wide and have a 14-deg. included angle.

The latch is made of tool steel, hardened and ground, and is ⅝ in. square in the bearing in which it is held cornerwise, so as to make it easy to take up for wear.

The lever for withdrawing the latch is made up of ½ in. square cold-rolled steel, 8 in. long, 3 in. at the top being turned down to receive the handle. A coil spring attached to the frame, and to the handle, holds the latch in the disc notch, locking the screw at its proper position, thus insuring perfect graduation.

The lever that carries the master nuts and the cutting tool is a steel forging, bored out and threaded, 2¾ in. in diameter, 24 threads per in., and sawed through at the back so as to clamp down on the bronze nuts; there are two nuts to provide adjustments for wear.

The tool head is made up of a piece of soft steel, 1¼ in. wide by 2 in. thick by 2¾ in. long, fitted to the lever with a knurled thumbscrew, to lock it to the lever at the proper location. On the right side is a slot to receive a ⅞ in. high-speed tool, which is ground to a sharp V, and is held in the head by a hardened tool-steel bolt, with a taper head flattened on one side. A slot, ½ in. wide is cut through at the bottom of this head to receive a roller ½ in. wide and ⅞ in. in diameter, which rests on the work, and the distance the tool is set below the roller is the depth of the graduation. The center of the roller is on a line with the cutting edge of the tool.



Machine used for graduating special rules or gages

The table is constructed of a piece of soft steel, 1¼ in. thick by 5 in. wide by 18 in. long and is supported by two ways, made of tool steel, hardened and ground, and lapped into the V's in the bottom of the table. On the top is a raised strip, ⅛ in. wide by 1/32 in. high, to aline the work against. A T-slot, running the full length of the table, holds the square heads of the bolts, which are used for clamping the work. A screw, op-

* Device presented by R. B. Loveland, toolroom foreman, Norfolk & Western, Roanoke, Va., at the annual convention of the American Railway Tool Foremen's Association at Chicago.

erated by a crank, moves the table in to the automatic stop.

The automatic stop is composed of a tool-steel disc, 1 in. thick by 4 in. in diameter, mounted on a ½ in. shaft and geared to the lead screw by a train of gears with which it is driven. One revolution of this disc represents one inch, and as one thirty-second is the finest graduation for which this machine is built, there are 32 pegs of hardened tool steel; one for each of the graduations. Each of the pegs is of proper length so that in graduating, one does not have to worry about the length of the marks. All that is necessary is to index the screw, and turn the handle on the front of the machine until the stop on the table engages the automatic stop, and then turn back until the table engages the back stop, which insured the tool being clear of the work, and then repeat the operation.

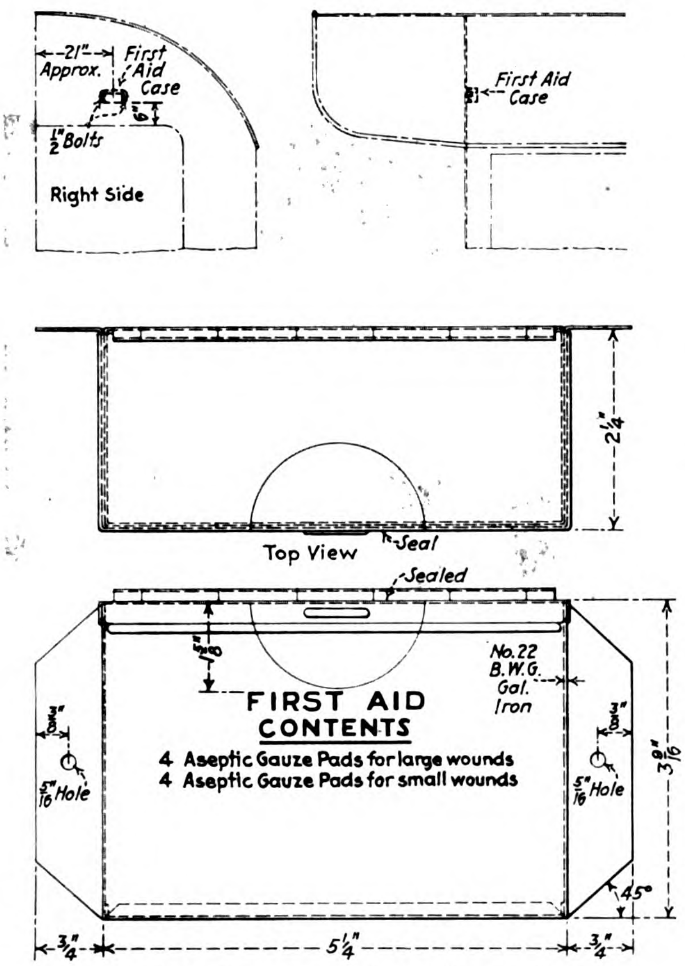
This machine is accurate and does neat regular work at a fair rate of speed for special jobs.

Locomotive First-Aid Cases

In some states, particularly the state of Illinois, locomotives, both steam and electric, must be equipped with first aid cases to comply with the provisions of the state laws.

The accompanying sketches show the type of first aid case that has been made standard on one of the railroads operating in Illinois. It is made from No. 22 B.w.g. galvanized iron, painted black and lettered in white showing the first-aid materials which it contains.

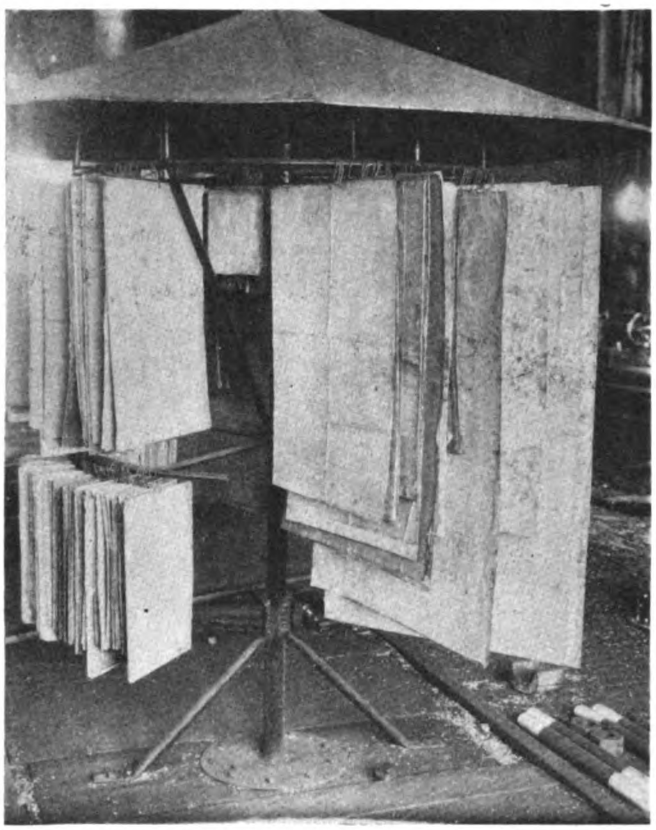
An ordinary car seal is recommended for protecting the contents as the seals are numbered. A record can then be kept at the issuing engine terminal and the case replenished should it become necessary for the engine crew to make use of any article while in service.



The first-aid case and its location in the cab

A Circular Rack For Blue Prints

In the machine shop of the D. & R. G. W., at Peublo, Colo., blue prints are made accessible and are at the same time kept clean by placing them on the welded pipe rack shown in the illustration. The 7-ft. section of 3-in. pipe which forms the central support of the rack is welded on a metal plate 18-in. in diameter which is bolted to the floor. Two angle braces of 1-in. pipe, welded to the upright section and bolted to the floor aid in making the rack secure. A circular section of 1-in. pipe, used to hold the small prints, extends part way around the rack 3-ft. above the floor. It is supported by two angle braces of 1-in. pipe which are welded in place.

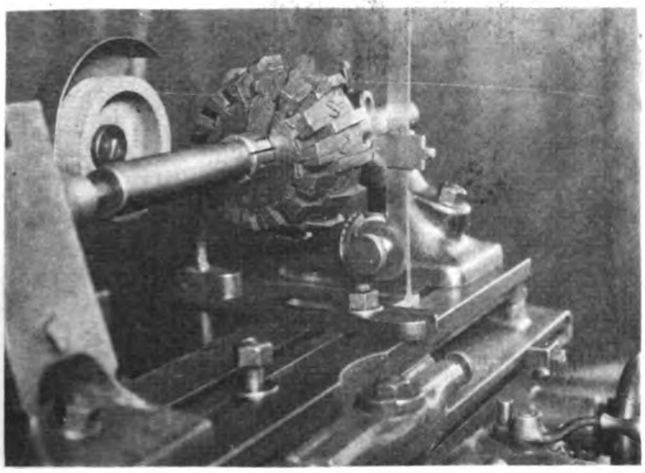


Circular rack used as a means for filing blue prints in the shop

A complete circle of 1-in. pipe, supported by three horizontal and three angle braces of the same material is welded in place 5-ft. above the floor to carry the larger prints. Another circle of ½-in. pipe, welded to the top of five 10-in. vertical sections of 1-in. pipe, supports the canopy roof of sheet metal on its frame of 1-in. tubing. Metal hooks are placed in the stiff top bindings of the prints to facilitate their being moved about on the rack.

Gaging Cutter Clearance and Rake

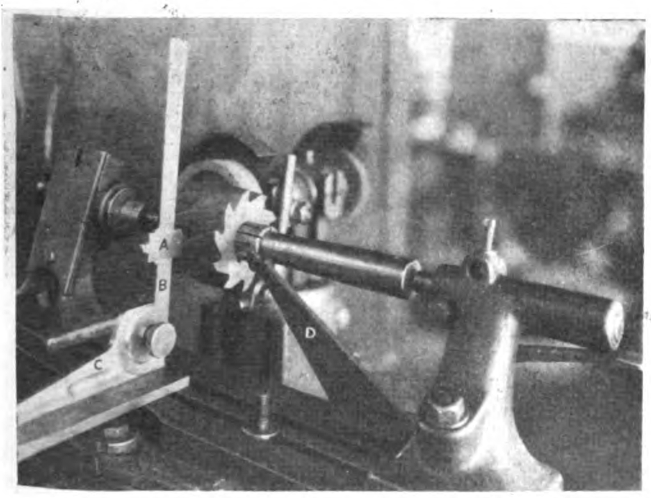
THIS gage* for checking the clearance and rake of milling cutters and reamers consists of a base *C* graduated in degrees as on an ordinary protractor, reading 45 deg. either way from the vertical. This base is used to support the upright arm or protractor blade *B* to which the vernier, graduated to allow readings to five minutes, is attached. The head *A*, fitted to the arm



Clearance and rake gage as used for checking larger inserted-blade cutters

or protractor blade with a set screw, comes into contact with the cutter or reamer. The secret of success in connection with checking the angle clearance on cutters and reamers lies in this head.

A head made to fit an ordinary 12-in. scale and a protractor would serve, but when fitted up with the base as illustrated, it is possible to check cutters from ½ in. to 24 in. in diameter, which make it a universal tool



Clearance and rake gage as used for checking a small, solid milling cutter

for all cutters and reamers. One of the fine points of this tool is that it is only necessary to set up on the grinder in the ordinary way and bring the cutter or reamer into contact with the grinding wheel and grind just a spot, then turn and check with the gage.

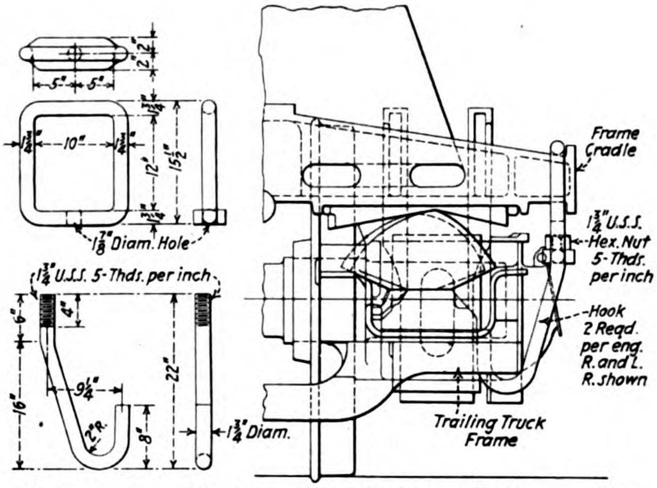
To adjust the head, which must be set even with the center of the cutter or reamer, first set the protractor at the desired angle, then use the center gage *D*, shown in one of the illustrations. The head can be used with a face for small cutters or with a face for large cutters.

It is purposed to work up a table of degrees for milling cutters and reamers for use in conjunction with this gage, and by stamping the table for cutters on one side of the blade and the table for reamers on the other, it will thus be possible to save considerable time and trouble. This table will be for general use. Cutters on reamers for special jobs, which require a different angle. can be produced by making records of the angles used.

* Device submitted by R. B. Loveland, toolroom foreman, Northern & Western, Roanoke, Va., at the annual Chicago convention of the American Railway Tool Foremen's Association.

Dropping Trailer Wheels

A NUMBER of roads have classes of locomotives on which the hook shown in the drawing can be used for suspending the frame of a trailing truck when dropping the wheels. The hook and carrier can be

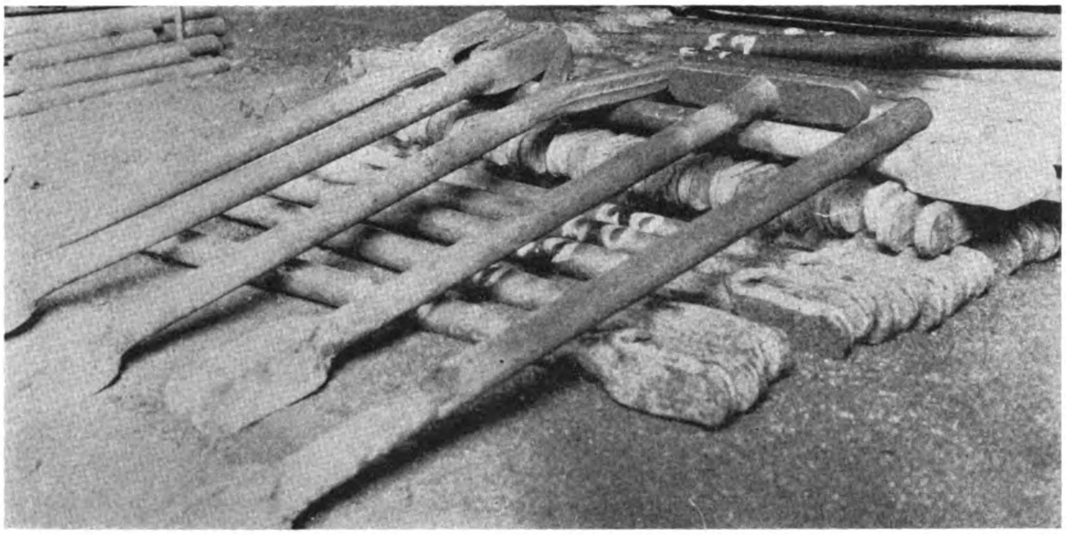


Design and application of the hook for holding trailing-truck frames when dropping the wheels

made in the blacksmith shop. The hooks, one on each side, are inserted under the frame of the trailing truck and the carrier is then slung over the end of the frame cradle. The nut is screwed down which draws the frame of the trailing truck and the cradle together. On completion of this operation, the wheels may be dropped while the frame will remain in position.

SLIP COACHES STILL IN USE.—The number of slip coaches now operating on the railroads of Great Britain is only 45, the practice having shrunk greatly from the year before the war when 177 such cars were operated. If any young American is at all hazy as to the definition of the term "slip coach" he should be reminded that it is a passenger car attached to the rear of an express train and which, with its passengers is detached from the train and stopped at a way station, without the stopping of the train.

The decline in the use of this arrangement is said to be due to the cost of additional brakemen, the need for specially fitted cars and the increasing use of corridor trains, on which passengers may desire to pass from the rear car to the dining car. The Great Western still has 34 daily "slips," though before the war there were on this road 70 or more. The London, Midland & Scottish, on whose lines there were before the war 44 such cars, now has none at all.



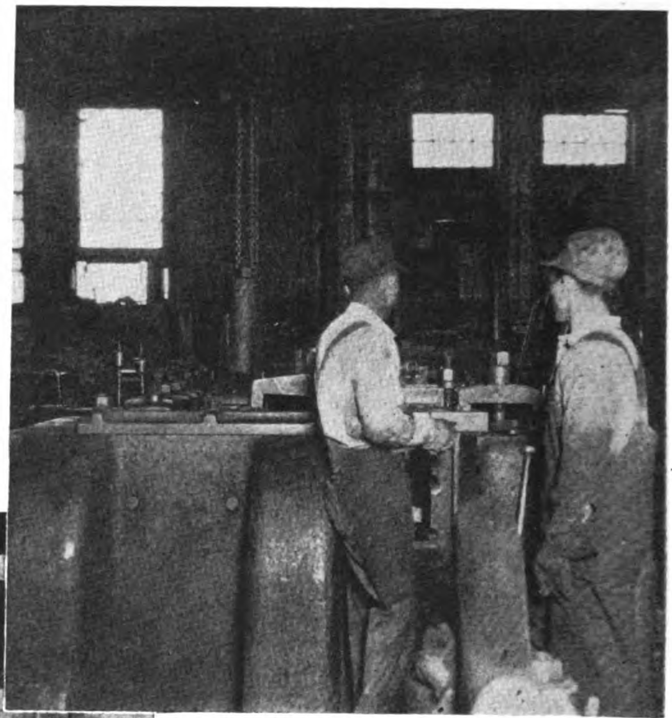
Left — How the rod looks at the end of the various steps required to form the jaw

Making Brake Rods On an Acme Machine

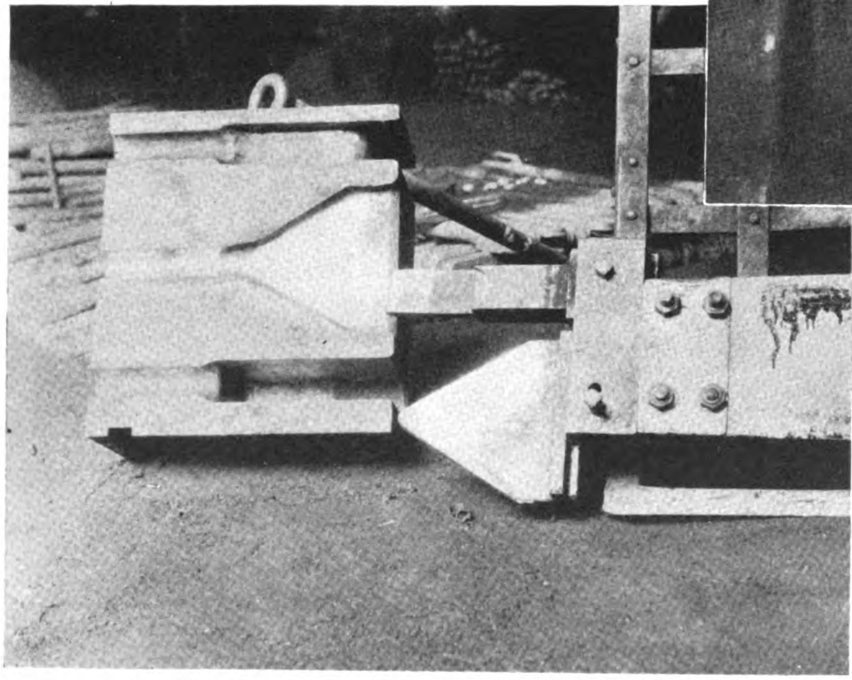
SPECIALLY developed dies and headers for an Acme 5-in. forging machine have simplified the manufacture of brake rods in the blacksmith shop of the Denver & Rio Grande Western, at Denver, Colo. The die blocks, the left one of which is shown in one of the illustrations, are 18 in. wide, 22 in. long and 8 in. thick. An eye bolt is inserted in the top of the die blocks and header blocks to facilitate their handling by a hoist.

Three different openings are used to form the jaw. The 1¾-in. round stock is first heated to a white heat at one end and thrust into the middle opening in the dies and the metal is gathered and split by the V-shaped header. It is then placed in an opening at the bottom of the block and flattened with a header, spreading the jaws at right angles to the rod. It is then re-heated and placed in the upper die opening which is large enough to allow the rod to slide. The smaller header forces the rod into this die, forming the jaws. These are finished by placing them on an anvil and striking two or three blows with a hammer after placing a flat bar in the fork. The rod is then allowed to cool after which the other end is formed with the same process. When cool again the pin holes are drilled in the jaws.

This method has been found to save the work of one man, over the sawing method of forming the jaws and it is also preferred to the various welding processes.



Forging the jaws on the brake rods

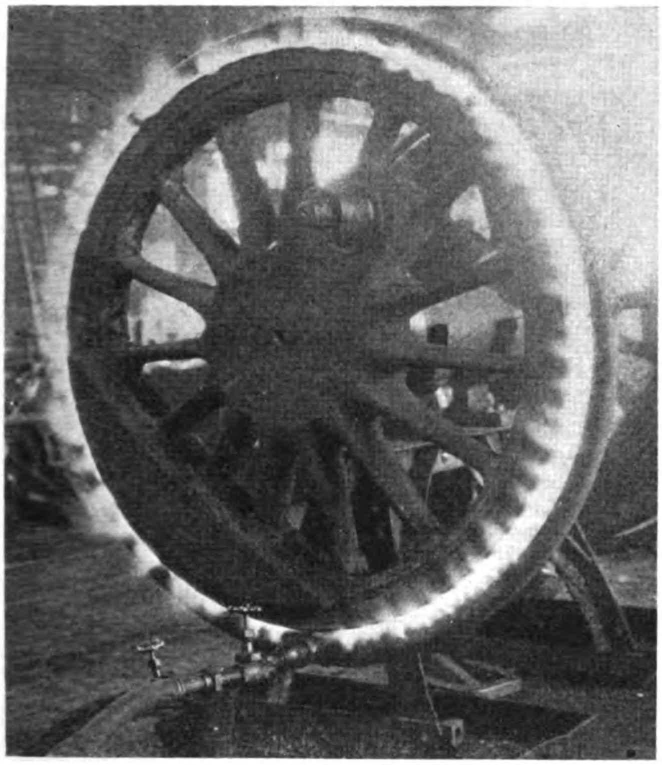


The V forming-die block and a pair of the forming headers

Gas Heat for Removing Tires

IN shops where most of the tire work is completed within the shop itself, the use of oil-heating apparatus often fills the building with a dense pungent smoke. Aside from creating uncomfortable working conditions it denotes an ineffective heating apparatus and an uneconomical consumption of the fuel. Confronted with these conditions, the wheel-shop foreman of the Pittsburgh and Lake Erie designed a gas-heating apparatus which produces an even flame of high intensity and which is capable of heating a tire in four minutes to the temperature necessary for removing or applying it.

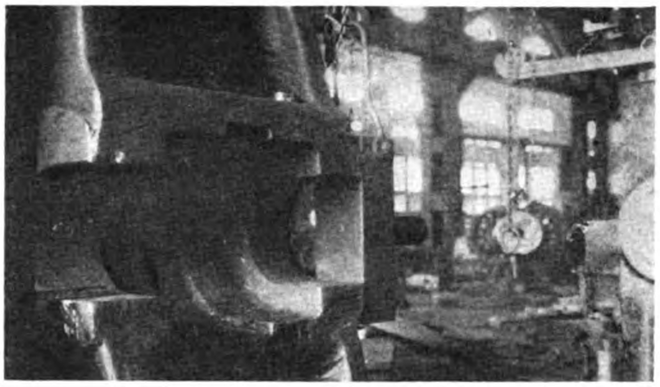
The tire hoop is constructed of 1½-in. pipe, the gas opening being $\frac{1}{16}$-in. slits which are sawed in the pipe at 2-in. intervals. The junction of the air and gas lines is of a special design and was perfected only after considerable experimentation. It consists primarily of a converging air-delivery tube set in the line at the junction of the two supply lines to facilitate the delivery of the gas to the hoop. The apparatus does not use an excess of gas and has proven to be far more economical than the oil heating equipment which it has replaced.



The gas flame is even and intense and heats the tire for removal in four minutes

Press Jig for Removing Crank Pins

THE holding of a pin set against a block in the wheel-press housing until hydraulic pressure brings the press head against the wheel is one of the more or less dangerous practices followed in the wheel shop while removing crank pins. The jig shown in the illustration was designed expressly for the purpose of eliminating this practice by incorporating the pin and block in one piece and suspending them from a crane.

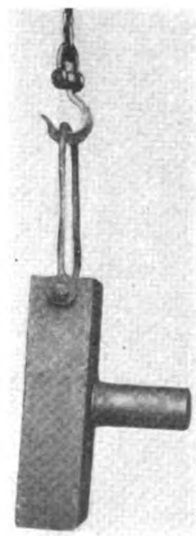


The jig eliminates the necessity of manually supporting a pin against the crank pin while the press head is being brought into position

The jig consists of an 8-in. by 12-in. by 24-in. steel block, machined square and drilled to a diameter of 2 in. in the center of the 12-in. face. A 15/16-in. hole is drilled in the 8-in. face of the block, 1-15/16 in. from the top, for the insertion of a ⅞-in. bolt. It is drilled off the center line towards the pin face of the block so that the block will hang straight when suspended from the crane hook. The bolt is used to attach an inverted-U shaped handle to the block.

A set of pins of various diameters is used with the jigs to press out crank pins of various sizes. One end of each of the pins is machined to the same size to fit loosely in the 2-in. hole in the block. Thus only one steel block is necessary for any number of pins.

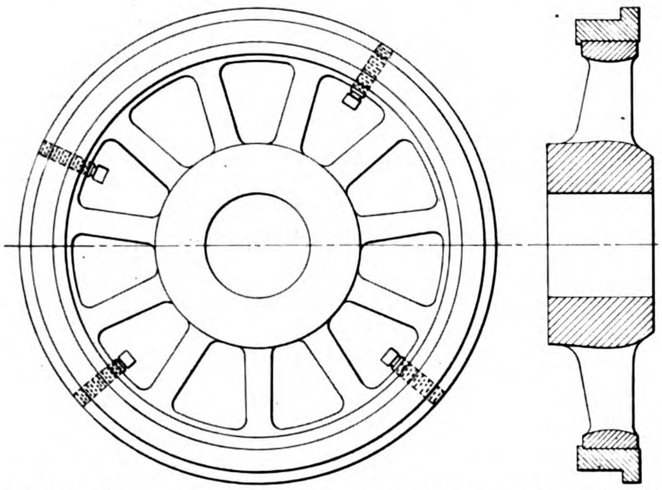
When in use, the pin of the size necessary for the removal of the crank pin is first chosen and set in the jig. The jig is then lifted into position against the wheel-press housing by the beam crane. The wheel or pair of wheels, as the case may be, is then swung into position, the pin of the jig being set against the crank pin on the inside face of the wheel. The wheel-press operator can steady the jig and the wheel with safety while the press head is being brought against the face of the wheel preparatory to applying the pressure for the removal of a crank pin.



The jig is a steel block suspended from a beam crane—Pins of various diameters can be inserted for the removal of a variety of crank-pin sizes

A Mandrel for Turning Tires

IN one of the illustrations is shown a pair of 44-in. driving tires mounted on a mandrel preparatory to machining the tread contour. The mandrel consists of a scrap pair of trailer-wheel centers and tires mounted on an axle, the tires being shrunk onto the wheel centers and machined with a shoulder against which the

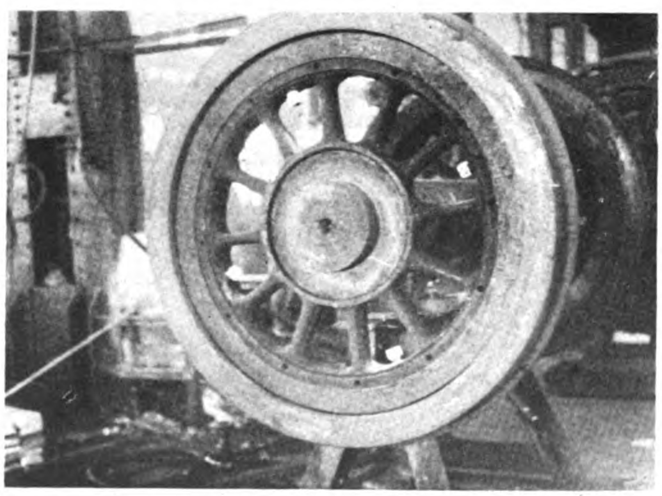


Trailer tires were shrunk on wheel centers and machined with a square shoulder to make this mandrel for turning driving tires

driving wheel tires are set during machining operation. The outside diameter of the trailer tires is machined $\frac{1}{16}$ in. less than the standard inside diameter of the driving-wheel tires which are to be machined.

When the driving tires are placed upon the mandrel, they are adjusted and centered by means of four set screws and a 1/32 in. liner. The pressure of the set screws is sufficient to hold the tires in place on the mandrel while it is being moved to the driving wheel lathe by a crane. After being mounted in the driving wheel lathe, the pressure of the chuck jaws against the tire prevents it from turning on the mandrel while the cut is being taken.

The mandrel was made in a wheel shop where a large number of tires were shipped from outside points for machining. Formerly, each tire was set up on a boring mill and machined at a cost of $1.40. A single pair of

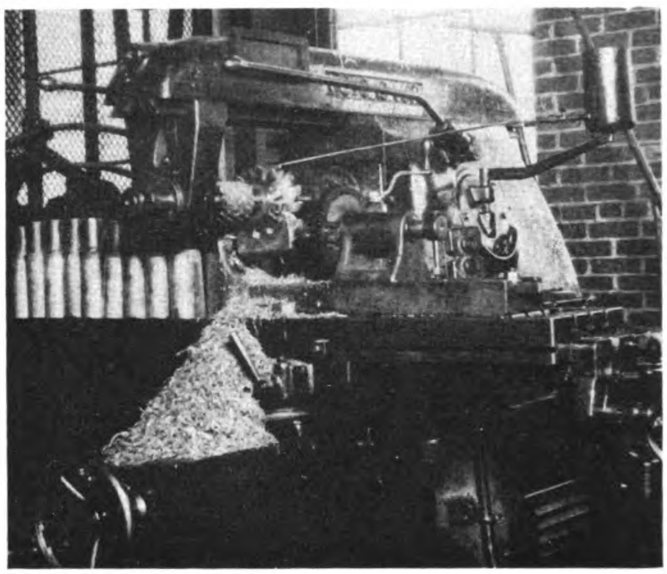


Driving tires set up on the mandrel preparatory to machining the flange and tread contour

tires was thus machined at a cost of $2.80, plus 30 cents for set-up time, a total of $3.10. The wheel-lathe price for turning a pair of tires mounted on wheel centers, in the shop referred to is $1.25. By using the mandrel the foreman of the shop thus saved the difference between turning two single tires on a boring mill and turning a pair of wheels on the wheel-lathe, which in this case was $1.85, exclusive of the time of the machinist and machinist helper who mounted the driving tires upon the mandrel.

Fixture for Milling Main-Rod Keys

IN the illustration is shown a method for milling, on a production basis, the flat sides and rod fit on keys for the front ends of main rods. The keys are held in



The milling operations on main-rod keys showing the slab and radially fluked cutters

an indexing fixture which has an adjustable head and center and which can be designed to hold several keys, the number depending on the size of the machine and the number of cutters which can be set up on the arbor at one time.

The keys, preparatory to milling, are centered on each end. They are then placed in the fixture and the two flat sides are milled with a slab milling cutter. After being revolved into a vertical position the semi-circular edge of the key is milled to the radius of the main-rod fit by a concave cutter, the radius of the flutes of which correspond to the radius of the main-rod fit.

Twenty-Five Years Ago.—The maximum working pressure for locomotive boilers has been gradually increased with the general trend of enlarged proportions and the demand for greater power. In the United States this pressure has been nearly doubled in the past 30 years. For some years prior to 1880 the standard boiler pressure on many roads was 125 lb. In 1885, 150 lb. was used by the more progressive lines, and in 1890, 160 was quite generally used. In 1895 the pressure had increased to 180 lb., and in 1900, 200 lb. was tried by a few roads. While some roads have gone as high at 210 and 220 lb., there are now seen signs of a decided change, making 200 lb. the limit, with a tendency to go below rather than above it.—Railway Age, December 15, 1905.

NEW DEVICES

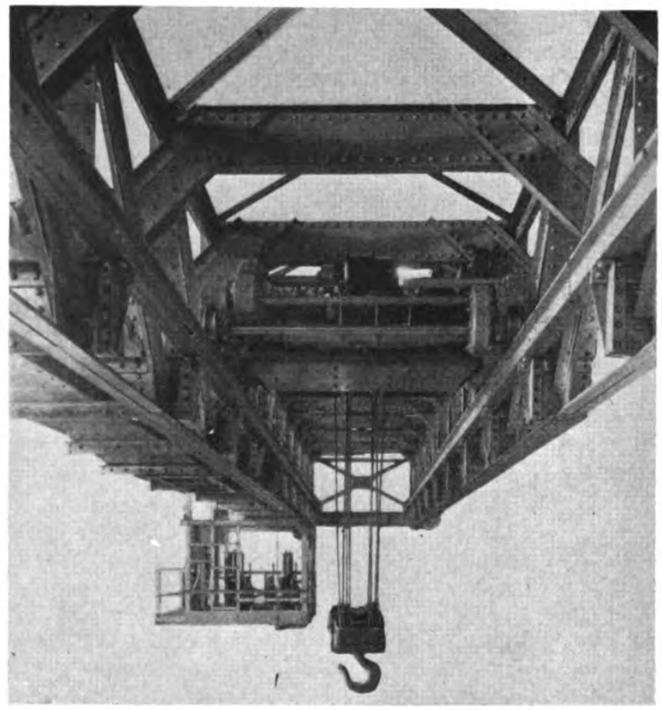
A 10-Ton Aluminum Crane

SIX very unusual overhead traveling cranes have recently been built by the Northern Engineering Works, Detroit, Mich., for the U. S. Aluminum Company of Pittsburgh, Pa., for its new sheet rolling mills located at Alcoa, Tenn. These cranes are especially interesting from several standpoints. The design and construction of the bridge is unusual and the crane, including the trolley, is made almost entirely from aluminum-alloy rolled structural sections and aluminum-alloy castings.

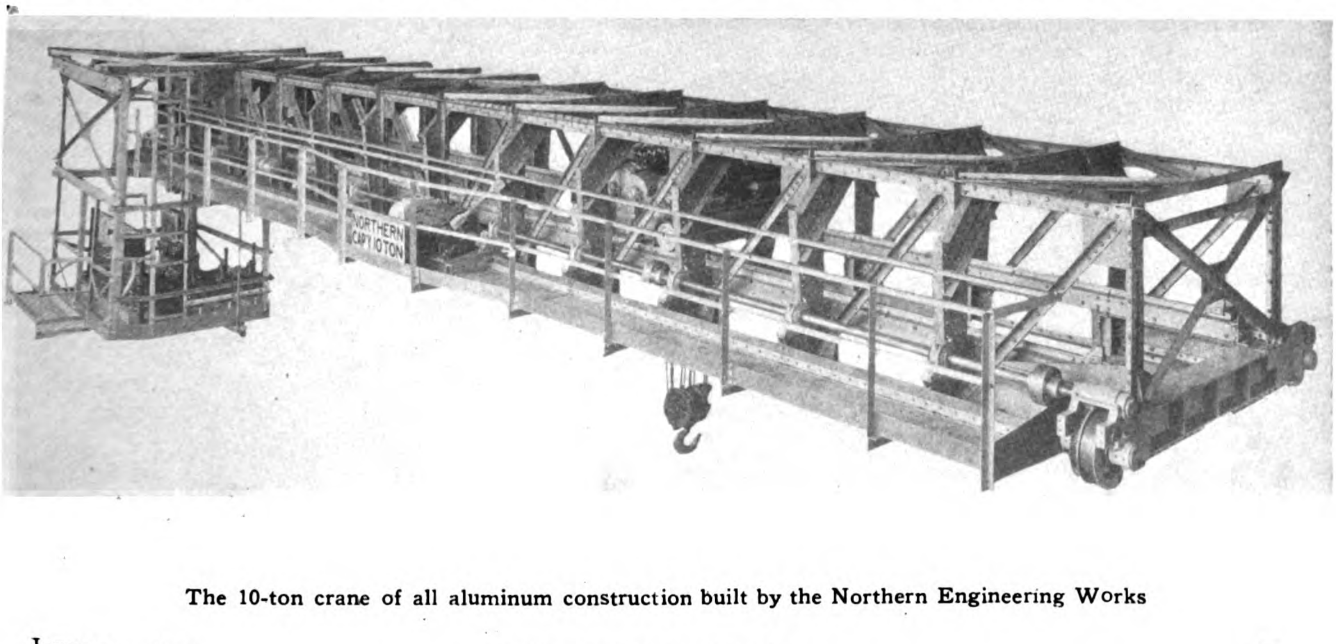
The crane illustrated has a capacity of 10 tons. The span of the bridge is 76 ft. 6 in. between truck wheels and the height of lift on the hoisting hook is 25 ft. Three mill-type motors, for 220-volt direct current, drive the hoist, bridge travel and trolley travel. They are provided with full magnetic control, placed in the operator's cab which is located at one end of the bridge. The hoist operates at a full-load speed of 50 ft. per min. and is provided with a 19-hp. motor. The bridge, fully loaded, travels at a speed of 400 ft. per min. and is also provided with a 19-hp. motor. The trolley is driven by a 4½-hp. motor and travels at a speed of 150 ft. per min.

The crane bridge is of latticed girder construction. The design not only accomplishes a saving in headroom, which was a factor in this installation, but reduces the weight of the structure under what it would have been with the conventional steel-plate girder section. It is interesting to note that all the rivets used in the structure, the T-rail on which the crane trolley runs, including the hook bolts and nuts that secure it to the girders, and all bolts, nuts, electric conduit and fittings are of aluminum. The footwalk which runs the full length of the bridge is made up entirely from aluminum, including the checkered floor plates.

The trucks which carry the bridge are aluminum castings, made from No. 195 alloy. All of the gear housings, gear covers, bearing housings, transmission cases and covers, and line-shaft bearings were made from aluminum alloy. The main line or driving shaft extending the full length of the bridge, which drives both end trucks, was made from aluminum and has a hollow center. The shaft is carried in self-aligning bearings spaced at regular intervals and the bearings are equipped for Alemite forced lubrication. Aside from the saving in weight due to the nature of the material employed, every part and member entering into the construction of the finished crane was designed for minimum weight and at the same time for maximum



A view of the bridge between the girders showing the crane trolley

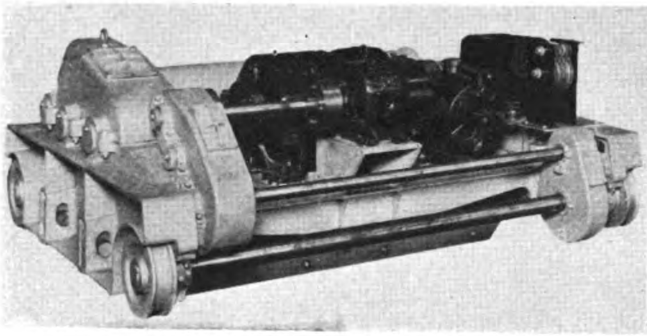


The 10-ton crane of all aluminum construction built by the Northern Engineering Works

effectiveness at the point where it was intended to function.

The bridge consists of two latticed-type girders with overhead bracing. The footwalk is attached to the lower chord of the left-hand girder which also supports the operator's cab. The operator's cab contains all the controls, magnetic panels, and complete switchboard equipment for the operation of the three motors located on the crane. The operator's cab like the rest of the crane bridge was made up from rolled aluminum structural plates, angles and rivets.

The trolley used on the crane is a standard Northern type NE fully enclosed crane trolley. The trolley sides or trucks, which include the lower portion of the gear housings, were made from aluminum-alloy castings as were the gear housing covers, bearing housings, and the connecting girt between the two trolley frames. The



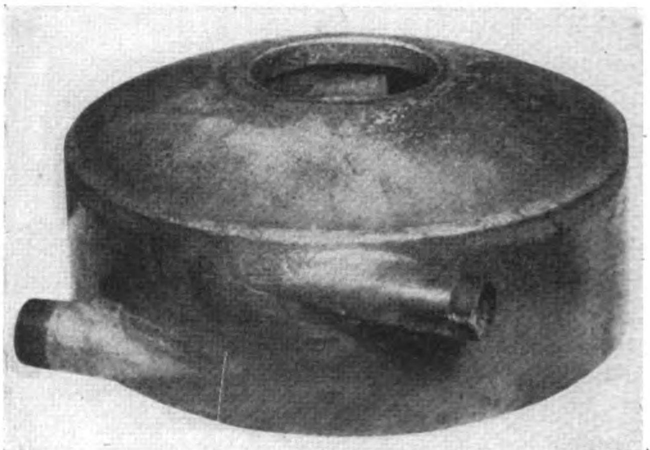
The crane trolley, the castings of which are all of aluminum alloy

trolley is of aluminum and is of double-girt construction, which permits the live-load stressed to be brought directly into the trolley sides. One of the girts is a rigid cast aluminum-alloy member that connects the two trolley sides and holds the trolley in rigid permanent alinement. Aside from this purpose it serves to carry the hoist motor but does not carry any of the live load. The other is a structural aluminum girt which carries the live load directly into the trolley sides and it is free to adjust itself to varying stresses. The trolley is provided with Hyatt roller bearings throughout the hoisting and traveling mechanism, and all bearings are furnished with Alemite forced lubrication.

Some interesting figures regarding relative weights of this crane employing aluminum and the same crane built of steel and iron can be given. The weight of the structural parts of the bridge in aluminum and with the latticed type girders is 16,300 lb. The same structural parts in steel and with the conventional plate-type box girder would have weighed 46,600 lb. The weight of the bridge complete without the trolley is 24,500 lb. In steel it would have been 58,000 lb. The weight of the trolley unit alone is 5,500 lb. In steel it would have been 8,300 lb. The total net weight of the entire crane, including the trolley, is 30,000 lb. In steel it would have been 77,100 lb. representing a total saving of 47,100 lb. in the weight of the complete, finished crane in service condition.

Bird-Archer Blow-Off Muffler

A BLOW-OFF muffler which is a radical departure from previous types has recently been developed by the Bird-Archer Company, New York, and is being tested on a Chicago & North Western switching locomotive in the Chicago district. The B-A muffler, as it is called, is made in the form of a separator, mounted on top of the boiler, and connected by suitable piping to the blow-off cocks. The separation of the steam and sludge-filled water is accomplished by the application of the cen-



Centrifugal-type muffler which is located on top of the boiler

trifugal principle. The blow-down enters the cylindrical muffler tangentially. The water is thrown to the outside, draining off by gravity through a discharge pipe and being delivered to the ash pan and thence to the track. The steam is discharged vertically into the air

Bird-Archer blow-off muffler applied for test purposes to a Chicago & North Western switcher

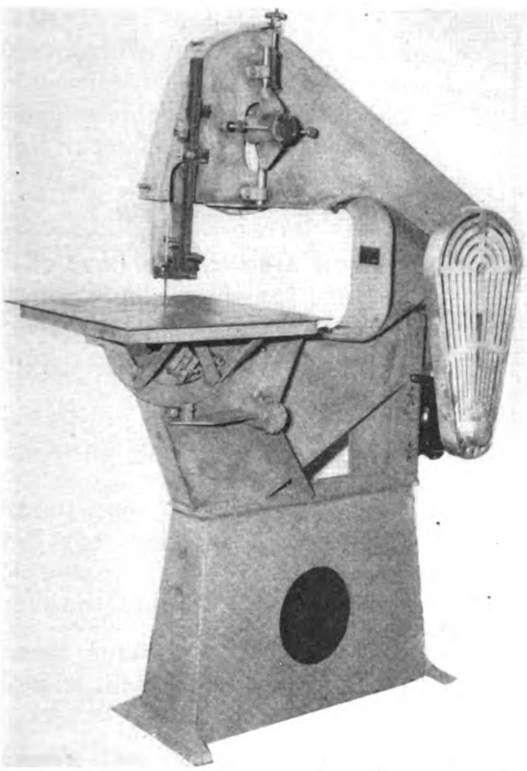
much like the discharge of the pops, except that there is much less noise.

Advantages claimed for the new B-A muffler design include satisfactory disposition of the blow-down with safety to all concerned; steam disposed of in such a manner as to cause no obstruction to the engineman's vision; absence of equipment or parts likely to clog up; delivery of sludge-filled water to the track without disturbance of the ballast or trouble due to blowing cinders or sand to the journals; consequent possibility of blowing off the boiler at any time needed, regardless of wind direction or wayside conditions.

All-Steel Fabricated Band Saw

A SERIES of all-steel fabricated band saws has recently been added to the line of the De Walt Products Corporation, Lancaster, Pa. The fabrication of the complete metal frame and stand was adopted to insure a machine which would be light in weight and of rugged construction, eliminating vibration, thus increasing the life of the saw blade.

The machines are built entirely by electric welding and are manufactured in two types, a two-wheel unit and



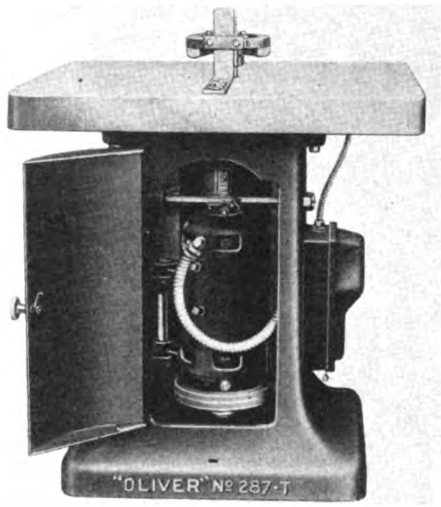
The De Walt band saw with all-steel welded frame and stand

a three-wheel unit. The two-wheel unit is a 16-in. capacity machine, while the three-wheel unit is built in capacities of 24 in. and 30 in. All models of the machine employ aluminum wheels 16½ in. in diameter mechanically balanced and mounted on Timken roller bearings with an adjustable tracking device for lining and adjusting the band-saw blade.

The use of the three pulley wheels was adopted in order to obtain greater throat clearance. The band-saw track and wheels are contained in one frame, completely enclosing all running parts, except that portion of the blade used in the cut. The ½-hp., ¾-hp., or 1-hp. motors with V-type pulley and belt, are included in the equipment furnished with the three types of saws.

A Single-Spindle Wood Shaper

THE latest developments in the products manufactured by the Oliver Machinery Corporation, Grand Rapids, Mich., is a single-spindle high-speed ball-bearing wood shaper or variety moulder. One of the outstanding features of the shaper is the high-speed spindle which makes it possible to feed the stock to the cutters with or against the grain in a single operation. The table is 36 in. square and 36 in. above the floor and, although that size table is standard equipment, larger



The Oliver high-speed wood shaper or variety moulder

tables can be furnished for special requirements. Dust chutes are cast integral with the table to prevent accumulation of dust near the spindle. A hole, 11 in. in diameter, in the center of the table has three large rings with flanges, the smallest of which has an inside diameter of 2 in. to allow the spindle adapter to rotate freely.

The Oliver detachable spindle, which is used on the shaper, has a wick-filter type of oil lubrication to prevent dust from entering the ball races. It is arranged with a brake connected to an automatic cut-off switch operated by a foot lever.

The shaper is built with the motor directly connected to the spindle with an aluminum fan built into the housing to keep the motor cool. The motor, yoke and spindle are raised and lowered as a unit by means of a hand wheel at the right of the operator. This motor drive require the use of a frequency changer or motor generator set giving a frequency of 100, 120 or 140 cycles to obtain speeds of 6,000, 7,200 or 8,400 r.p.m. respectively.

The machine may also be arranged for a belted motor drive operating with a 3,600 r.p.m. ball-bearing motor mounted in a vertical position with an endless fabric belt transmitting the power to the spindle.

A third method consisting of a V-belt motor drive, developed by the Oliver Machinery Company, is unique

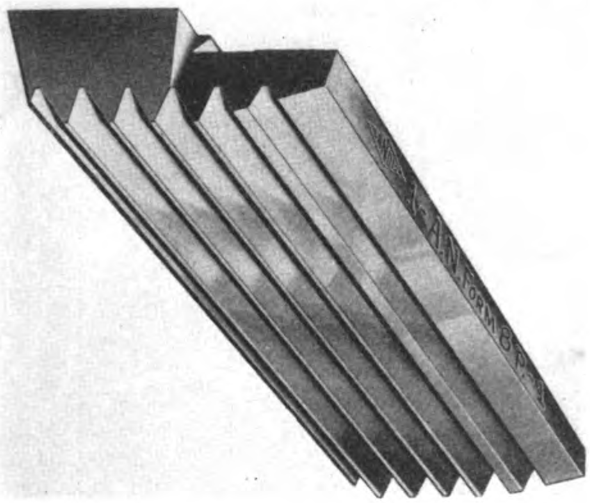
(Continued on second left-hand page)

in that it gives compact drive for any high-speed shaper without the use of a frequency changer. Back of the shaper-spindle yoke is suspended a 3,600 r.p.m. vertical ball-bearing motor in a self-contained adjustable arrangement, with a twin V-belt type of drive reaching from the lower end of the motor to the lower end of the shaper-spindle to give a spindle speed of 7,200 r.p.m.

Landis Ground Thread Chasers

THE Landis Machine Co., Inc., Waynesboro, Pa., has developed and placed on the market a ground thread chaser which is designed to insure a high degree of thread accuracy. The thread form is ground on special grinding machines, the process removing the minor inaccuracies and distortions resulting from the heat treatment and producing a uniform thread form with a flat crest and root.

The ground thread form was adopted to obtain greater accuracy and freer cutting action in order to



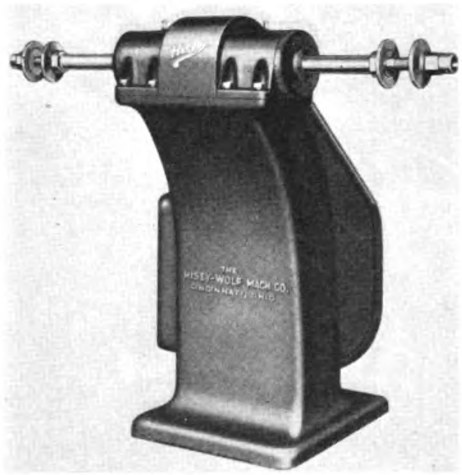
The Landis ground thread chaser for Lanco, Landex and Landmatic die heads

increase the life of the chaser between grindings. The ground thread chasers are available for all sizes of Lanco and Landex die heads and for the 5/8-in., 7/8-in., 1 1/4-in. and 2-in. Landmatic die heads.

The Hisey TexDrive Buffer

THE Hisey Model M TexDrive buffing and polishing machine with open type spindle extensions is the latest addition to the line of grinding equipment manufactured by the Hisey-Wolf Machine Company, Cincinnati, Ohio. The machines are available in 3-hp., 5-hp. and 7 1/2-hp. sizes. They are designed with the Hisey gooseneck construction, the spindle and buffing wheels extending out from the base of the machine to permit easy handling of large or odd-shaped pieces. The motor mounting is of the external type with a rigid four-point support, Tex-rope drive being utilized to transmit power to the spindle. The motor is equipped with ball bearings and is furnished with a dovetailed sliding base including a gib with the necessary locking screws. Proper belt tension and accurate alinement of the motor is adjusted by means of a hand wheel and feed screw.

The spindle is of one-piece design made of nickel steel

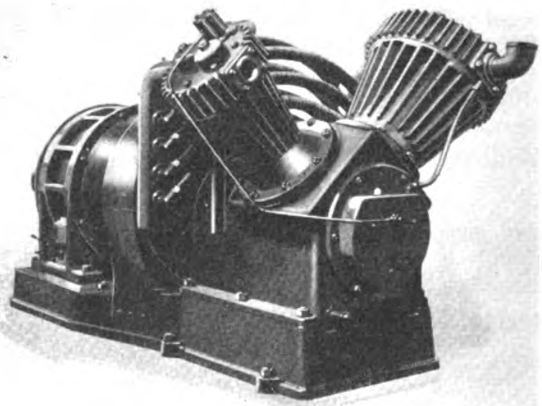


The Hisey model M TexDrive buffing machine

and machined to the exact diameter in order to insure balancing. The spindle is mounted in ball bearings, although Timken roller bearings can be furnished if desired. The bearing boxes are keyed to the column of the machine. The key is located along the entire base of the bearing housing and fits in a keyway on the top of the column. This design was adopted in order to insure perfect realinement of the bearing housing, regardless of how often the housing is taken off.

Compressor for Train-Line Charging

IN the illustration is shown a two-stage air-cooled compressor which is designed especially for train-line charging service. It is a self-contained unit mounted, together with a directly connected motor, on a single-



The Ingersoll-Rand type TIC compressor for charging train lines

sub-base. The unit, manufactured by the Ingersoll-Rand Company, 11 Broadway, New York, and designat-

(Continued on next left-hand page)

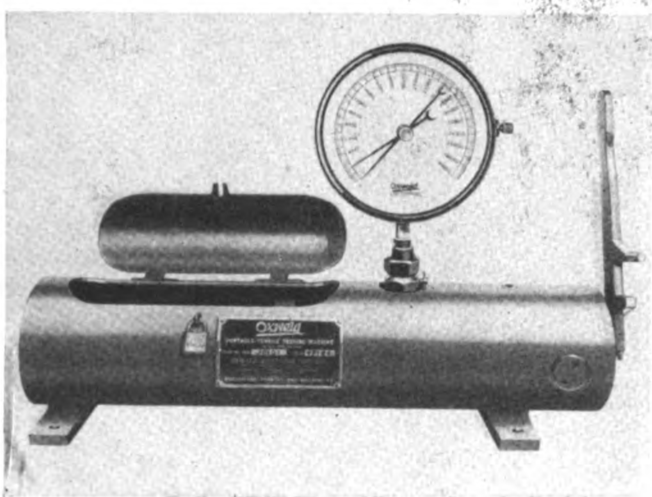
ed as its type TIC compressor, has a piston displacement of 155 cu. ft. per min. and is designed to furnish a discharge pressure of 100 lb. per sq. in.

It is equipped with automatic stop-and-start control, which maintains a fixed air pressure and provides for operation only when air is being used. Ball bearings are used throughout the motor and compressor and these, together with other moving parts of the unit, are automatically lubricated. The motor is protected by an air-sealed unloader which unloads both cylinders and the intercooler whenever the compressor starts and stops. Pumping of oil is prevented by two oil-control rings and the moving parts are protected against dust and dirt by an enclosed crankcase.

Tensile-Testing Machine

A PORTABLE tensile-testing machine, designed to facilitate the testing of welds in the field and in the shop has recently been placed on the market by the Oxweld Acetylene Company, 30 East Forty-Second street, New York. It was developed in co-operation with the Union Carbide and Carbon Research Laboratories, Inc., weighs 165 lb., measures 28 in. in overall length and is 6¾ in. in maximum diameter. It consists of a tubular compression member with a set of grips in the head and a hydraulic cylinder block in its base. The cylinder block contains a communicating pump and cylinder directly machined into a single block, the cylinder pressure operating a piston carrying a second set of grips.

The specimen to be tested is placed between the jaws, which have spring grips. When operating, a release valve is closed and the pump handle applied at the end of the cylinder is moved back and forth. A set of conical blocks has also been constructed to fit into the machine head in place of the grips so that the standard ½-in. round specimens may be tested if desired. The load is measured directly in pounds per square inch by a suitable, calibrated pressure gage actuated by the pressure in the cylinder. The gage is one of the essential parts of the apparatus. When a test is finished the pressure may be released by a valve and the piston may be returned by using the pump handle as a lever.



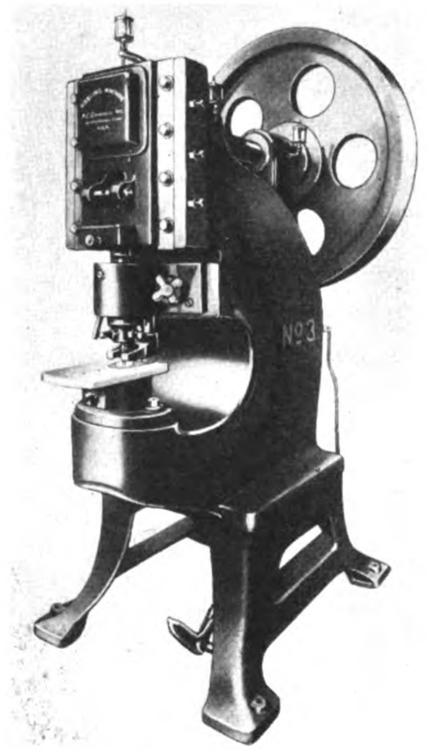
The Oxweld portable tensile-testing machine for weld specimens

This machine makes it possible to secure a tensile test result immediately after welds are made. It is used for determining welders' ability and also facilitates making periodic check tests of the operators and in many cases provides a ready means for testing sections cut at random by the inspector from completed work.

The machine is a self-contained, totally enclosed unit and when closed for shipment, presents a smooth cylindrical surface.

Campbell ¾-in. Capacity Nibbling Machine

THE Campbell No. 3 nibbling machine has been brought out by A. C. Campbell, Inc., Bridgeport, Conn., to fulfill the need for a machine for cutting all kinds of shapes from sheet metal ⅜ in. to ¾ in. in thickness. It is designed not only for cutting original



The Campbell No. 3 nibbling machine

pieces, but also for production work where the making of punches and dies is not desirable.

The machine cuts at a speed of approximately 20 linear in. per min. in any direction. Like the smaller nibbling machines it works on the circular punch and die principle with a pilot to prevent the work from slipping and the punch from taking too large bites. The cutting is clean without burr and very little finishing is necessary when a smooth edge is required.

It is designed to handle a large variety of work. Circles can be cut with a circle-cutting attachment which is furnished with the machine. For making original cuts the use of a straight edge and the French curve is recommended to insure close cutting to the line. The original piece may be used as a template for cutting duplicate pieces since the punch is designed to follow the template accurately. The machine has three strokes

(Continued on next left-hand page)

—1 in., 13/16 in. and ½ in.—with a capacity for handling all thicknesses of sheets from ⅜ in to ¾ in. A ⅞-in. punch can be set in the die by turning the stroke adjustment collar. The stripper plate is set in correct position by releasing the locking lever and turning the handwheel.

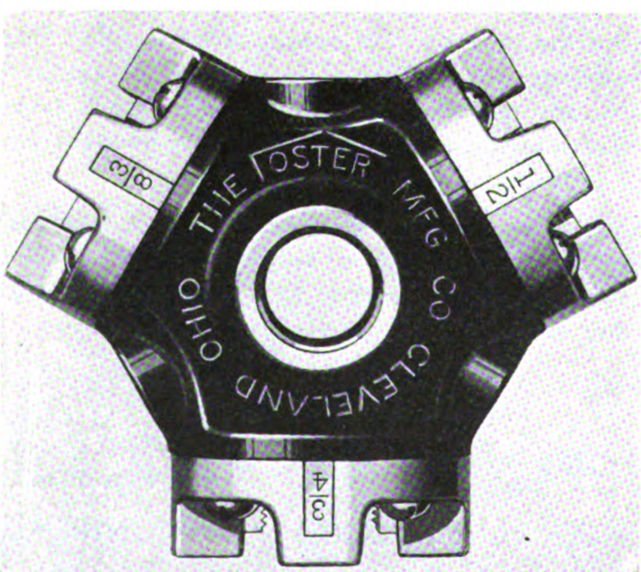
The following are the specifications for the machine: floor space required without motor, 5 ft. by 4 ft. 2 in.; height over wheel, 8 ft. 6 in.; pulley size, 50 in. diameter by 7½ in. face; pulley speed, 105 r.p.m.; depth of throat, 15 in.; horsepower required, 7½ hp.; net weight, belt drive, 9,000 lb.; shipping weight, belt drive 9,500 lb.; maximum cutting capacity, ¾ in.; punch diameter, ⅞ in.

Heavy-Gear Lubricants

A SERIES of gear lubricants for all types of heavy. low moving, open gears, has recently been brought out and designated as the Tenac No. 1, No. 2, No. 3 and No. 4 greases by the E. F. Houghton & Company, Philadelphia, Pa. Of these various grades of Tenac, the No. 1 is the heaviest of the series, while No. 4 is the lightest grade. Tenac No. 3 and No. 4 can operate satisfactorily where low atmospheric temperatures are encountered. No special device or method of application is required with the use of the Tenac series, their application to the gears being taken care of in the same manner as other lubricants used for the same purpose. The Tenac series was developed in order to provide lubricants of consistency that would not be thrown off the gears while in motion and which would decrease frictional losses by overcoming metal to metal contact.

Three-Way Tool Threader

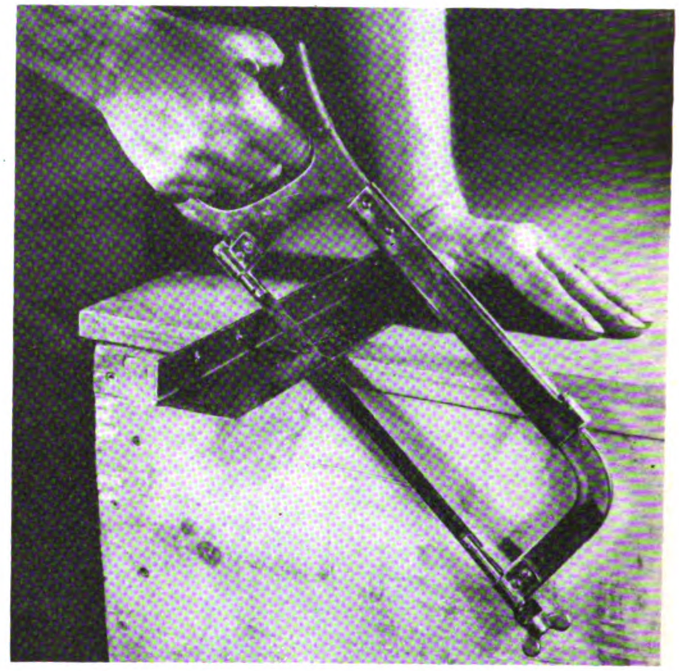
A THREE-way threader for ⅜-in., ½-in. and ¾-in. pipe that will cut a standard-length thread on a pipe as close as 4⅝ in. to a wall, has recently been developed by The Oster Manufacturing Company and the Williams Tool Corp., of Cleveland, Ohio. This threader, designated as the No. 000 Chip Chaser, uses the same open type die holders as the regular Oster Chip Chasers, allowing a large area for oiling and chip clearance. The No. 000 threader is small, light in weight and is equipped with a large size ¾-in. handle.



The Oster three-way tool threader for threading pipe close to a wall

Semi-Flex Hacksaw Blade

THE L. S. Starrett Company, Athol, Mass., recently placed on the market its Semi-Flex hacksaw blade. The Semi-Flex, as the name implies, is flexible and is designed for use on jobs that strain or twist the blade.


The Semi-Flex blade being used on angle-iron which usually chatters and binds when cut by the ordinary type of blade

It is made of tungsten steel and tempered to prevent shelling of the teeth.

It was developed to take care of troublesome jobs such as the cutting of pipe, angle iron, wire cable, electric conduit, BX cable and similar soft or thin materials which cannot be cut readily by the ordinary type of blades.

SMALL MODELS.—The recent show of the Model Engineers of Great Britain rather specialized in tiny exhibits. Among the models constructed to extremely small scales was an 0-6-0 tank locomotive in L.M.S. colors, claimed to be the smallest working steam locomotive in the world. It had an overall length of 4¾ in. and was capable of running continuously for 12 min. It was driven by a small oscillating cylinder connected by gearing to the driving wheels, and would haul a load of 2 lb. 10 oz. Another miniature locomotive was a small Southern Railway 0-4-4 tank engine barely 2 in. in length and weighing just under 1 oz. It was operated by an electric motor concealed in the boiler, running at over 8,000 r.p.m. and giving a locomotive speed of 2 m.p.h. The engine was mounted in a case complete with a short length of track.

(Club and Association News on next left-hand page)

There is a way-

to protect railway piping from atmospheric corrosion

IN the railway field, as elsewhere, the superior durability of Copper-Steel Pipe in exposure to the elements has been proved beyond question.

Railway uses for Copper-Steel Pipe are many and varied because of the severe corrosive conditions to which most railway equipment is subject. And wherever Copper-Steel Pipe has been tried, for resistance to atmospheric corrosion, the savings accomplished have far outweighed the small extra investment.

For all piping on locomotives and cars, for signal piping, tubular poles, or any use in which pipe encounters alternate wet and dry exposure, this extra durable pipe is recommended. May we send you printed matter? Ask for Bulletin 11, describing NATIONAL Copper-Steel Pipe—

The Original Copper-Steel Pipe

NATIONAL TUBE COMPANY · Pittsburgh, Pa.
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US STEEL

Among the

Clubs and Associations

CAR FOREMEN'S ASSN. OF CHICAGO.—At the meeting of the Car Foremen's Association of Chicago which will be held on January 12 at 8 p. m. at the Great Northern Hotel the new A. R. A. rules will be discussed.

CLEVELAND RAILWAY CLUB.—The A. R. A. mechanical rules effective January 1, 1931, will be discussed at the meeting of the Cleveland Railway Club which will be held at 8 p. m. on January 5 at the Hotel Hollenden, Cleveland, Ohio.

RAILWAY CAR MEN'S CLUB OF PEORIA AND PEKIN.— Changes in interchange rules will be discussed at the meeting of the Railway Car Men's Club of Peoria and Pekin which will be held at the Union Depot, in Peoria, Ill., on January 16 at 7 p. m.

EASTERN CAR FOREMEN'S ASSOCIATION.—The January 23 meeting of the Eastern Car Foremen's Association will be held at 29 West Thirty-Ninth street, New York, at 8 p. m. T. O'Donnell will lead in a discussion of the A. R. A. Rules of Interchange.

ST. LOUIS RAILWAY CLUB.—Further Possibilities of Efficiency in Railroad Transportation will be discussed by D. L. Forsythe, general road foreman of equipment of the St. Louis-San Francisco, before the meeting of the St. Louis Railway Club which will be held at 8 p. m. on January 9 at the Hotel Statler, St. Louis, Mo.

PACIFIC RAILWAY CLUB.—Fred W. Venton, assistant manager, railroad sales department, Crane Company, will be the speaker at the meeting of the Pacific Railway Club which will be held on Thursday evening, January 8, at 7:30 at the Hotel Oakland, Oakland, Cal. Mr. Venton's topic will be the Proper Method of Piping a Locomotive; How to Eliminate Screwed Joints.

CANADIAN RAILWAY CLUB.—The Hon. J. H. Rainville, chairman of the board, Montreal Harbour Commissioners, will present an address on the subject of Free Ports before the meeting of the Canadian Railway Club to be held at 8 p. m. on January 12 at the Windsor Hotel, Montreal, Canada. Moving pictures will be shown previous to the address by the Honorable Rainville.

NEW ENGLAND RAILROAD CLUB.—"Peace River Surveys and Canadian Pacific Branch Lines" will be the title of the paper to be presented by T. C. Macnabb, engineer of construction of the Canadian Pacific, at the January 13 meeting of the New England Railroad Club which will be held at 6:30 p. m. at the Copley-Plaza Hotel, Boston, Mass. This meeting will be the annual feature of the New England Railroad Club designated as Canadian Night.

INDIANAPOLIS CAR INSPECTOR'S ASSOCIATION— The next meeting, to be held at Hotel Severin, Indianapolis, Ind., on January 5, 1931 will be devoted primarily to a discussion of the changes in the A. R. A. Interchange Rules. The discussion period will be preceded by a 15-min. safety talk by a representative of one of the railroads in Indianapolis. There will be a noon-day luncheon meeting of the executive committee at the Hotel Severin on the above date at which any who are interested in car department matters are invited. At the January meeting of the association the following new officers, elected at the December meeting, will be installed: Chairman, L. C. Geisel, district master car builder, C. C. C. & St. L.; vice-chairman, W. L. Thayer, car foreman, C. I. & L. and secretary-treasurer, E. A. Jackson, A. R. A. inspector, N. Y. C. & St. L.

A.S.M.E. Holds Fifty-First Annual Meeting

American Society of Mechanical Engineers.—Meeting held December 1 to 5, inclusive, Engineering Societies Building, 29 West Thirty-Ninth street, New York. Fifty-first annual meeting; total registered attendance 2,657. ¶ In addition to a program of 72 technical papers on a variety of mechanical engineering subjects contributed by 14 professional divisions of the society and a large number of reports by research and technical committees, the annual meeting was featured by an exhibit of over 200 paintings, etchings and sculpture done by engineers who have followed art as an avocation. A series of three lectures on "Talking with an Audience" were given by Dr. S. Marion Tucker, head of the Department of English, Brooklyn Polytechnic Institute. A general conference on employment was held under the sponsorship of the American Engineering Council and at the request of Col. Arthur S. Woods, chairman of President Hoover's Emergency Committee for Employment. Colonel Woods and L. W. Wallace, executive secretary of the American Engineering Council, presented the problem for discussion at this conference. ¶ Roy V. Wright, editor, *Railway Mechanical Engineer,* and managing editor, Railway Age, was inducted into office on Tuesday evening, December 2, as president of the society for 1931. This meeting was also featured by a discussion on engineering, economics, and the problem of social well-being by Ralph E. Flanders, manager, Jones & Lamson Machine Company, Springfield, Vt., and a vice-president of the A.S.M.E., and Dr. Wesley C. Mitchell, director of the National Bureau of Economic Research, New York. ¶ The Railroad Division, as in previous years, developed its program for the annual meeting from papers of particular interest to railway mechanical engineers contributed by other professional divisions of the society. This program was published on page 665 of the November issue of the *Railway Mechanical Engineer.* The division program consisted of three papers and the annual report of progress in railway mechanical engineering during the past year. A. F. Stuebing, vice-president, Bradford Corporation, New York, and chairman (1930) of the Executive Committee, Railroad Division, presided at the first session, Tuesday morning, December 2. The first paper pre-

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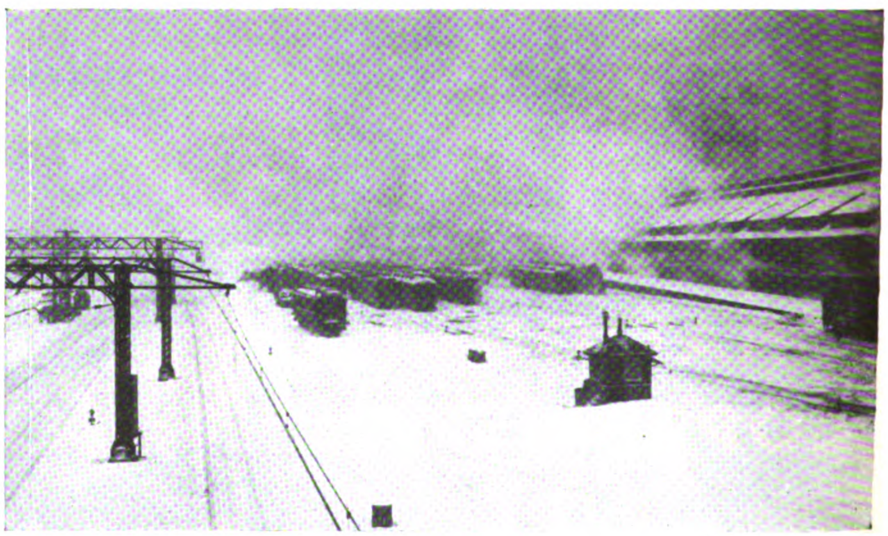

The Twelfth Street coach-yard of the Illinois Central at Chicago during the blizzard of December 17, 1929

sented was on "High-Pressure and High-Temperature Steam for Locomotives," by Dr. C. F. Hirshfeld, chief of research, the Detroit Edison Company, Detroit, Mich. The second paper was by R. Roosen, chief engineer, Henshel & Sohn, A. G., Kassel, Germany, on "The Stug System of Pulverized Fuel-Firing on Locomotives," and which was presented by W. H. Winterrowd, vice-president, Lima Locomotive Works, Inc. ¶ The entire afternoon session, which was presided over by Eliot Sumner, assistant to the general superintendent of motive power, Pennsylvania, and chairman (1931) of the Executive Committee, Railroad division, was devoted to the presentation and discussion of a paper by T. H. Symington, president, T. H. Symington & Son, Inc., Baltimore, Md., on "Research Relating to the Action of Four-Wheel Freight-Car Trucks." An abstract of Dr. Hirshfeld's paper, Mr. Symington's paper and a summary of the ensuing discussions are included in this issue. An abstract of Mr. Roosen's paper will be published in a later issue. ¶ An additional attraction held in connection with the annual meeting of the A.S.M.E. was the ninth national exposition of power and mechanical engineering, which was held during the same week in the Grand Central Palace, New York. Over 400 firms exhibited products, of which over 50 were manufacturers of small tools and machine tools. The remainder, about 350, were exhibitors of power-plant boilers and accessory equipment.

Club Papers

Cleveland Union Terminal Electrification

Cleveland Railway Club.—At the December meeting of this organization, held at the Hotel Hollenden, Cleveland, Ohio on December 1, 1930, H. W. Pinkerton, electrical engineer, Cleveland Union Terminals Company gave a talk on the electrification problem of the new Cleveland Union Terminal. ¶Mr. Pinkerton pointed out that this electrification project should be of exceptional interest to railroad men because of the fact that it is the first 3,000-volt direct-current installation in the East applied to a main-line railroad where heavy passenger traffic is involved. His talk indicated the complexity of the problems that had to be considered before the final selection of the equipment for the terminal could be decided upon in view of the grade and curve conditions encountered in the 16-mile territory which makes up the electrified zone. ¶Mr. Pinkerton explained in detail the equipment installed to operate the trains in the terminal district and in his talk told of the facilities that have been included for the proper maintenance and inspection of the electric locomotives.

Air-Brake Equipment

Manhattan Air Brake Club.—Meeting held December 17 in Room 2300, 150 Broadway, New York. ¶ The members of the Manhattan Air Brake Club discussed the following subjects at its December meeting; No. 6-E and No. 6 distributing valves; U-12-B universal valve; Limits of piston-flange thickness of pistons to be regrooved; Gas-electric rail car equipment, and variable release valve for auxiliary reservoirs. ¶ An expression of opinion was asked of the members as to the results being obtained with the 3/64-in. service port in the No. 6-E distributing valve and whether or not any difficulties were being experienced in meeting the sensitive tests for service port capacity and emergency, respectively. Information was requested as to the average condition of the ½-in. ball check in the emergency slide valve and the ⅛-in. choke plug with a 1/16-in. hole in the port leading to the emergency piston of the U-12-B universal valve when removed at regular cleaning periods. ¶ Information was given as to the limits of piston-flange thickness of pistons sent to the air brake department to be regrooved for various air-brake devices such as the equalizer piston of various types of universal valves, the main pistons of K and L triples, etc. The modified No. 6 ET equipment for gas-electric rail cars was described and explained.

The Locomotive Boiler

New England Railroad Club.—Meeting held November 4 at the Copley-Plaza Hotel, Boston, Mass. Paper by H. L. Miller, Republic Steel Corporation, entitled "The Thermal Expansion of the Locomotive Boiler and its relation to Failures of Material." ¶ Mr. Miller reviewed the development of the materials used in the construction of the modern locomotive boiler and firebox and gave considerable attention to the progress made in the design of staybolts, use of wrought iron, mild steel, nickel steel and various other alloys; boiler appliances such as Thermic syphons, Martin water tables, water tube fireboxes, superheaters, etc. He illustrated his paper with numerous charts showing the magnitude of the temperature and expansional stresses which cause the heavy repairs found necessary on many large locomotive boilers. ¶Mr. Miller's paper was discussed at considerable length, one of the speakers stating that the chemical composition of an alloy steel might be perfect from a metallurgical point of view and still not give satisfactory results, because the fabrication of steel and heat treatment are equally important with the chemical analysis.

Handling of Commodity Cards

Chicago Car Foremen's Association.—Meeting held at the Great Northern hotel, Chicago, Monday evening, December 8. Paper on the subject "Handling of Commodity Cards and Elimination of Oil and Grease Spots from the Floors of House Cars for High-Class Commodity Loading," by F. J. Swanson, district master car builder, Chicago, Milwaukee, St. Paul & Pacific, Minneapolis, Minn. ¶Mr. Swanson called attention in his paper to the necessity of furnishing clean, well-maintained equipment, in order to meet the keen competition now confronting the railways, and urged strongly the need of close co-operation between the operating and car department forces in this important work. He said that, while some railroads use commodity cards in the attempt to secure the proper classification of equipment, others do not and that a uniform practice, applicable to all roads, is desirable. Advantages of this practice, according to Mr. Swanson, include decreased switching costs, fewer empty car-miles, improved distribution of equipment and reduced storage of "rough" box cars. ¶ Referring to the general subject of the use of commodity cards, Mr. Swanson said: "One railroad has what is considered a very efficient and practical system of handling commodity cards and inspection. All empty cars coming from shop or repair tracks are inspected according to the class of lading for which they are fit, commodity cards being applied on each side of the car just below the car number. Empty cars received in train and interchange yards are likewise inspected and handled in the same manner, with the exception that, if cars arriving in train or interchange yards carry commodity cards less than 30 days old, they are not inspected outside of the regular running inspection. Any car carrying a commodity card over 30 days old is reinspected at the point inspected and a new commodity card applied as to what the car is fit for." ¶ The railroad mentioned uses nine different classification or commodity cards for house cars which inform station agents, yard-masters and others, where there are no car inspectors employed, what lading can be put in these cars without inviting damage claims. Mr. Swanson maintained that the introduction of such a system, accompanied by the proper classification of equipment, greatly reduces unnecessary car-miles now made by "rough" freight cars which can be put back in first-class service by simply sweeping or washing. He said that the proper application of commodity cards assists the transportation department in setting cars at different platforms and industries in accordance with the commodity to be loaded and has a tendency to prevent the costly practice, now all too prevalent, of loading products such as hides, oils, greases, paints and creosoted products in high-class equipment. Mr. Swanson's discussion regarding the methods of eliminating oil and grease spots will be given in full in later issue of the *Railway Mechanical Engineer.*

The Boiler Troubles Due to Feedwater

Western Railway Club.—Meeting held at the Hotel Sherman, Chicago, Monday evening, December 15. Paper presented on the subject "Feedwater and Its Relation to Boiler Troubles," by T. F. Powers, assistant superintendent of motive power and machinery, Chicago & North Western. ¶ Mr. Powers opened his paper by explaining that the primary purpose of a locomotive boiler is to generate steam and that the efficiency with which this is done depends upon many factors, the most important of which is the provision of feedwater free from large deposits of scale

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and mud. He recalled the early days, before the present extensive scientific treatment of feedwater, when a reduction of locomotive failures, due to leaking boilers, to 50 a month was considered an excellent performance on the North Western. Today, millions of locomotive-miles are now being made by many railroads, with boiler failures occurring at very infrequent intervals. ¶ Mr. Powers said that in the past ten years the North Western has studied feedwater conditions extensively and that, on some divisions, most of the water supplied is treated in wayside plants which, in his opinion, provide the best and most satisfactory way of treating water. He said, however, that where the volume of business handled does not justify the investment in these plants, internal treatment is beneficial and the North Western is using the latter method extensively with good results. While much has been accomplished in reducing boiler failures on the road, Mr. Powers said that corrosion and pitting still presents a baffling problem and that "this form of boiler cancer is responsible for the expenditure of millions of dollars each year by American railroads. In some districts, it is not unusual to remove and scrap entire sets of flues because of pitting after nine to eighteen months' service....Locomotive boilers are pitting in districts today that, in former years, were free from this trouble." ¶Mr. Powers referred to the Gunderson electro-chemical method for the prevention of boiler corrosion, several applications of which are now favorably under test on the North Western, but said that its general application to locomotives in pitting districts cannot be decided upon until the expiration of these tests. Mr. Powers mentioned the use of alloy steel, protective coatings and excessive water treatment as possibly helping to solve the pitting problem, and discussed the embrittlement of boiler plate which, he thinks, with the proper water treatment, can be materially decreased, if not eliminated. ¶The closing paragraph in Mr. Powers' paper seems worth quoting in full: "I have tried in this paper to express from the viewpoint of a mechanical officer some of the difficulties experienced from improper feedwater and to outline in a general way what has been accomplished by improving it. Definite progress had been made; but there is still much to be accomplished. If improvement is to continue, it is necessary that close co-operation exist between the water engineers and other officers in the mechanical and other departments. It is important that mechanical department officers keep the water engineers constantly advised of difficulties existing in locomotive operation due to water troubles. Thus by the proper study of water conditions, they may be in a position to recommend to operating officers expenditures necessary and savings to be effected. In conclusion I wish to again emphasize that many of the troubles occurring in locomotive boilers can be materially reduced if proper feedwater is furnished. I feel that our managements now realize that the furnishing of proper feedwater to locomotives effects a real economy and is definite assurance of good operating conditions."

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

Air-Brake Association.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

American Railway Association.—Division V. —Mechanical.—V. R. Hawthorne, 59 East Van Buren street, Chicago.
Division V.—Equipment Painting Section.—V. R. Hawthorne, Chicago.
Division VI.—Purchases and Stores.—W. J. Farrell, 30 Vesey street, New York.
Division I. — Safety Section. — J. C. Caviston, 30 Vesey street, New York.
Division VIII.—Car Service Division.—C. A. Buch, Seventeenth and H streets, Washington, D. C.

American Railway Tool Foremen's Association.—G. G. Macina, 11402 Calumet avenue, Chicago.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.
Railroad Division.—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York.
Machine Shop Practice Division. — Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.
Materials Handling Division.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.
Oil and Gas Power Division.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.
Fuels Division.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

American Society for Steel Treating.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

American Society for Testing Materials.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa

American Welding Society.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

Association of Railway Electrical Engineers.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

Association of Railway Supply Men.—J. W. Fogg, MacLean-Fogg Lock Nut Company, 2649 N. Kildar avenue, Chicago. Meets with International Railway General Foremen's Association.

Boiler Maker's Supply Men's Association.—Frank C. Hasse, Oxweld Railroad Service Company, 230 N. Michigan avenue, Chicago. Meets with Master Boiler Makers' Association.

Canadian Railway Club.—C. R. Crook, 2276 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month except in June, July and August, at Windsor Hotel, Montreal, Que.

Car Department Officers Association.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

Car Foremen's Association of Chicago.—G. K. Oliver, 3001 West Thirty-ninth Place, Chicago, Ill. Regular meeting, second Monday in each month, except June, July and August, Great Northern Hotel, Chicago, Ill.

Car Foremen's Club of Los Angeles.—J. W. Krause, 608 South Main street, Los Angeles, Cal. Meetings second Monday of each month except July, August and September, in the Pacific Electric Club building, Los Angeles, Cal.

Car Foreman's Association of Omaha, Council Bluffs and South Omaha Interchange.—Geo. Kriegler, car foreman, Chicago, Burlington & Quincy, Sixteenth avenue and Sixth streets, Council Bluffs, Iowa. Regular meetings, second Thursday of each month at Council Bluffs.

Car Foremen's Association of St. Louis.—F. G. Weigman, 720 North Twenty-third street, East St. Louis, Ill. Regular meeting first Tuesday in each month, except July and August, at American Hotel Annex, St. Louis, Mo.

Central Railway Club of Buffalo.—T. J. O'Donnell, 1004 Prudential building, Buffalo, N. Y. Regular meeting, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

Cincinnati Railway Club.—D. R. Boyd, 453 East Sixth street, Cincinnati. Regular meeting second Tuesday, February, May, September and November.

Cleveland Railway Club.—F. L. Frericks, 14416 Adler avenue, Cleveland, Ohio. Meeting first Monday each month, except July, August and September, at Hotel Hollenden, East Sixth and Superior avenue.

Eastern Car Foremen's Association.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings fourth Friday of each month, except June, July, August and September.

Indianapolis Interchange Car Inspection Association.—E. A. Jackson, Box 22, Mail Room, Union Station, Indianapolis, Ind. Regular meetings first monday of each month at Hotel Severin, Indianapolis, at 7 p.m. Noon-day luncheon 12:15 p.m. for Executive Committee and men interested car department matters.

International Railroad Master Blacksmith's Association.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

International Railroad Master Blacksmith's Supply Men's Association.—J. H. Jones, Crucible Steel Company, of America, 650 Washington boulevard, Chicago.

International Railway Fuel Association.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago.

International Railway General Foremen's Association.—William Hall, 1061 W. Wabash street, Winona, Minn.

International Railway Supply Men's Association.—W. J. Dickinson, acting secretary, 1703 Fisher building, Chicago. Meets with International Railway Fuel Association.

Louisiana Car Department Association.—L. Brownlee, 3730 South Prieur street, New Orleans, La. Meetings third Thursday in each month.

Master Boilermaker's Association. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

Master Car Builders' and Supervisors' Association.—See Car Department Officers Association.

National Safety Council—Steam Railroad Section: W. A. Booth, Canadian National, Montreal, Que. William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

New England Railroad Club.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting, second Tuesday in each month, excepting June, July, August and September. Copley-Plaza Hotel, Boston.

New York Railroad Club.—Douglas I. McKay, executive secretary, 26 Cortlandt street, New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York.

Pacific Railway Club.—W. S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

Pueblo Car Men's Association.—I. F. Wharton, chief clerk, Interchange Bureau, Pueblo, Colo.

Railway Business Association. — Frank W. Noxon, 1124 Woodward building, Washington, D. C.

Railway Car Men's Club of Peoria and Pekin.—C. L. Roberts, chief clerk, Peoria & Pekin Union Railway, 217 Lydia avenue, Peoria, Ill.

Railway Club of Greenville.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meetings third Tuesday of each month, except June, July and August.

Railway Club of Pittsburgh.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Regular Meeting fourth Thursday in month, except June, July and August. Ft. Pitt Hotel, Pittsburgh, Pa.

Railway Equipment Manufacturers' Association.—F. W. Venton, Crane Company, 836 South Michigan avenue, Chicago. Meets with Traveling Engineers' Association.

Railway Fire Protection Association.—R. R. Hackett, Baltimore & Ohio, Baltimore, Md.

Railway Supply Manufacturers' Association.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

St. Louis Railway Club.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

Southern and Southwestern Railway Club.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, June, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

Supply Men's Association. — E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division, American Railway Association.

Supply Men's Association.—Bradley S. Johnson, W. H. Miner, Inc., Chicago. Meets with Car Department Officers Association.

Traveling Engineers' Association. — W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio. Next convention March 25 to 28, 1931, Hotel Sherman, Chicago.

Western Railway Club.—W. J. Dickinson, 343 South Dearborn street, Chicago. Regular meetings, third Monday in each month, except June, July and August.

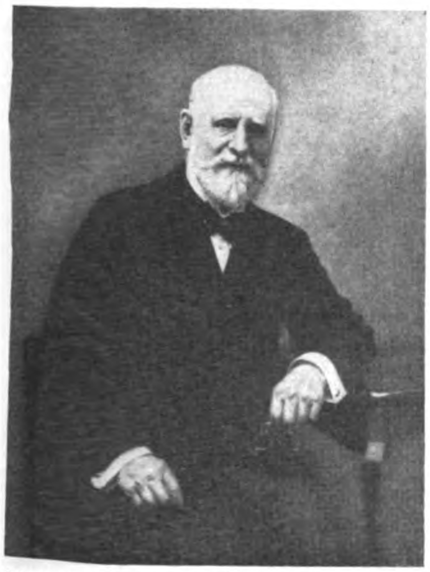
NEWS

Canadian National 4-6-4 Type Locomotives—A Correction

THE LIST of special equipment applied on the Canadian National 4-6-4 type locomotives, a description of which appeared in the December, 1930, *Railway Mechanical Engineer,* page 693, showed the grates as being of Hulson design. The grates applied to all five of these locomotives are of Canadian National standard design with reduced air openings.

The Bullard Company Commemorates Fiftieth Anniversary

IN COMMEMORATION of the fiftieth anniversary of the Bullard Company, established in 1880 by Edward Payson Bullard



Edward Payson Bullard, founder of the Bullard Company

as the Bridgeport Machine Tool Works, a portrait of the founder was hung in the main lobby of the new Bullard administration building on Canfield avenue, Bridgeport, Conn. Beneath the portrait is a bronze tablet inscribed with a sentiment indicative of the reverence with which Mr. Bullard's efforts and achievements are held by his successors. In 1894 the organization was incorporated as the Bullard Machine Tool Company and since 1929 has been known as The Bullard Company.

Born in 1841, Edward Payson Bullard at the age of 17 commenced serving an apprenticeship in the Whitins Machine Works, Whitinsville, Mass., at the completion of which he entered the employ of Colt's Armory at Hartford, Conn., subsequently becoming connected with the Pratt & Whitney Company.

After working for a number of years in the mechanical departments of the machinery business, he entered the merchandising field and, while being thus employed, established the Bridgeport Machine Tool Works. Lathes were the first products of this company, but the first big success came upon the adaption of the vertical boring mill principle to smaller unified machines of the vertical type. It was thus that the basic principles for the present Bullard production machines were laid.

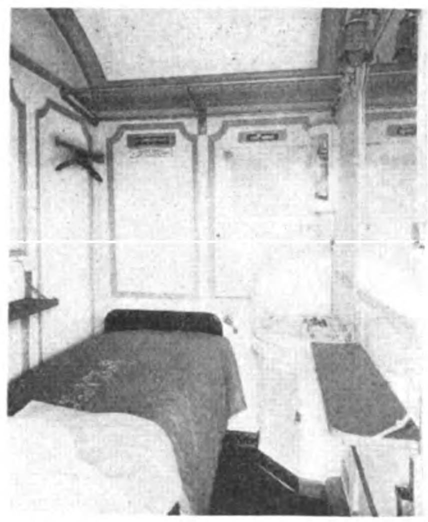
Before the death of the founder in 1906, he submitted to his engineers the basic design of the Bullard automatic multiple production equipment, having foreseen the possibility of automatic multiple production in the machine field. The new design adhered naturally to the vertical principle and was essentially six complete machines in one, each unit complete in itself and subject to individual adjustment in order that it might meet the varying conditions of operation which it would perform. The final result of the basic design was the building of the Bullard Mult-Au-Matic and the Bullard Contin-U-Matic vertical turret lathes.

Group picture of Bullard employees taken in 1887

New Sleeping Cars for L. N. E. of Great Britain

THE LONDON & NORTH EASTERN of Great Britain has recently placed in service several new sleeping cars, embodying many new features of interior design and decoration. These new cars, recently constructed by the L. N. E., include complete departures from previous practices.

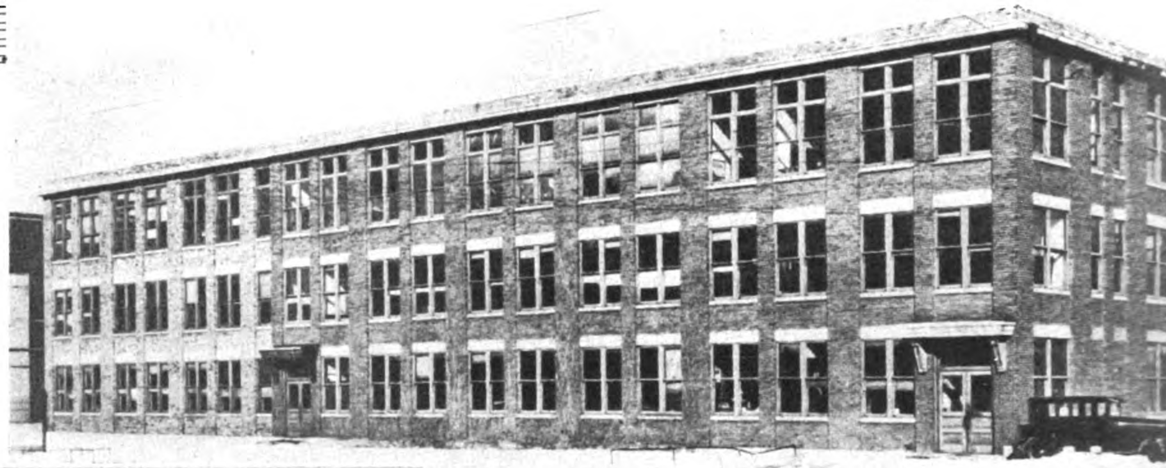
Among the more important new features introduced is the painting of the interiors. Until recently, polished wood was used almost exclusively in the interior decoration of British sleeping car berths. The colors have been so chosen that each compartment, which is fitted with a regular bed, has the appearance of a small well-appointed bedroom. The floor is covered with Persian design close covered carpet having a ground of dark blue; the corridor is covered with similar carpet having a line border all around. Hot and cold water is supplied to each compartment which has a wash bowl fitted in the corner near the window. A large mirror is placed centrally on the intermediate partition and a full length mirror is fixed on the door leading to the corridor. A folding table is provided on the intermediate partition and another one to take a tea tray is placed over the bed. A shelf is fitted over the bed head.



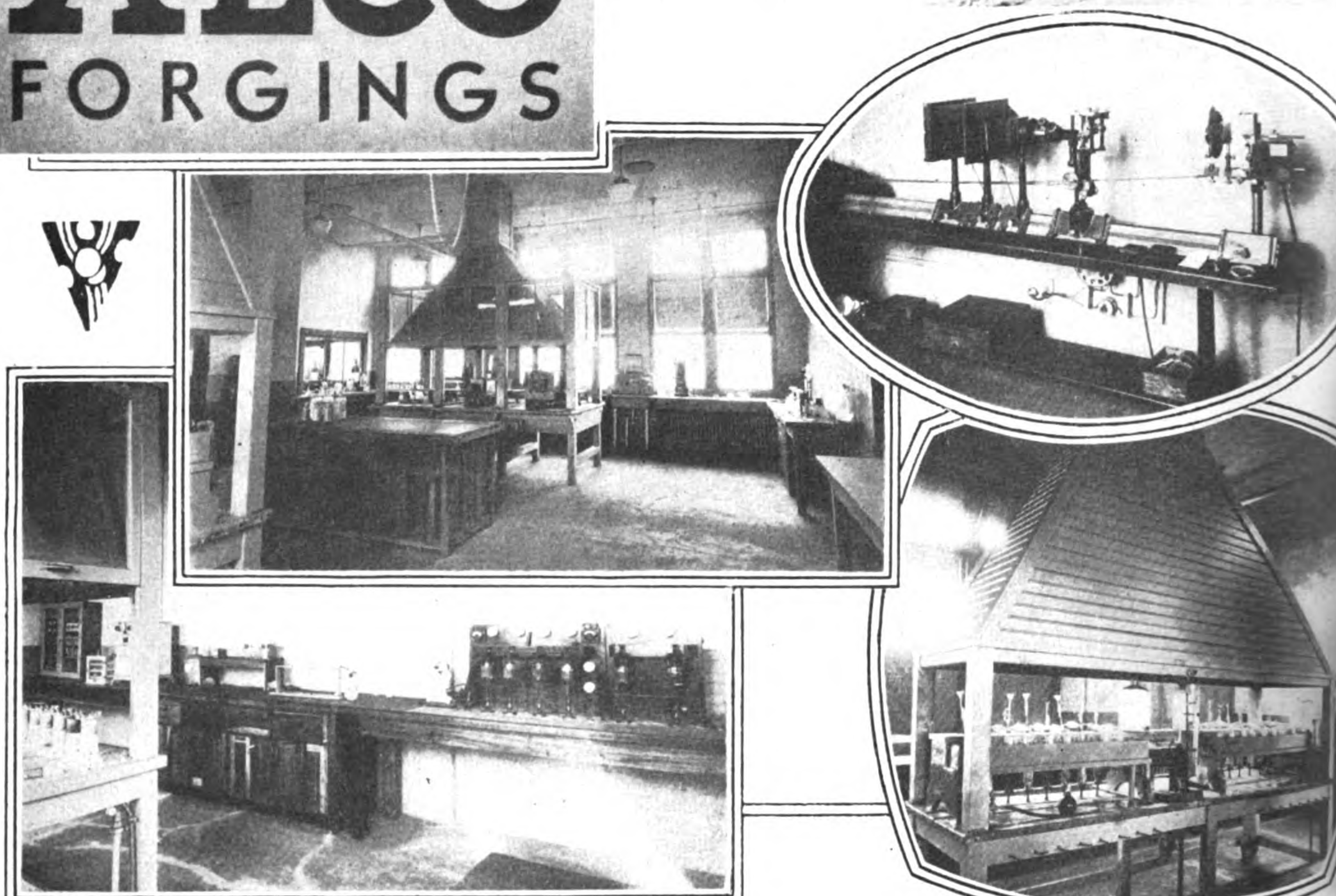
Interior of compartment as seen from corridor

The lighting is provided by a 30-watt opal lamp carried in a special fitting in the centre of the ceiling; a reading lamp is included under the shelf over the bed head. There is also a lamp enclosed in a silk shade on the partition over the mirror. A steam-heat radiator is provided on the partition below the mirror, the regulator controlling it being placed near the bed head. In addition to the ventilation provided by means of window and extractor ventilators, the car is fitted with pressure ventilation. The air supplied to each berth is drawn through a filter by a noiseless electric blower fan at one end of the corridor. A toilet compartment is provided at one end of the corridor. The attendant's compartment is at the opposite end of the car, and is

(*Continued on second left-hand page*)



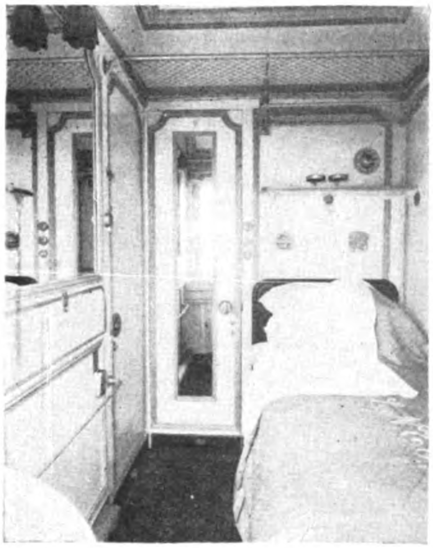
ALCO
FORGINGS



AMERICAN LOCO
30 CHURCH STREET

fitted with the necessary cupboards for crockery, sink, etc., to enable light refreshments to be served. The apparatus for supplying hot water to the berths is also included in the attendant's compartment and forms one of the principal features of the car. The water is heated by electricity, and thereby it has been possible to dispense entirely with gas.

The cars are built of teak, and special



View of compartment looking toward door

attention has been paid to the elimination of noise. The body itself is carried on India rubber pads insulating it from the steel frame, and compressed "Wadnit" asbestos felt has been placed between the upper and lower courses of the double floors. The same felt is also used to fill in all space between the inner and outer roof and body sides. The floors are covered with sponge rubber half an inch thick under the carpets.

The overall length of each car is 63 ft. 6 in., the body being carried on a steel underframe mounted on two standard L.N.E.R. four-wheel compound-bolster 8 ft. 6 in. wheelbase trucks. Pullman vestibules are also included.

Supply Trade Notes

I. L. Ward has been appointed Pacific Coast representative for the Union Railway Equipment Company, with office at 503 Market street, San Francisco, Cal.

The Centrifix Corporation, Cleveland, Ohio, has appointed the Wyman Engineering Sales Company, Cincinnati, Ohio, its representative in the Cincinnati district.

The General Motors Corporation, Detroit, Mich., has purchased the Electro-Motive Company, Cleveland, Ohio, and will operate the latter as a separate company with the same personnel.

Paul Llewellyn, formerly president of the Interstate Iron & Steel Company, Chicago, has recently been elected to serve as the chairman of the board of the Empire Steel Corporation, Mansfield, Ohio.

Owen H. Persons, assistant manager of sales of the American Steel & Wire Co., with headquarters at Philadelphia, Pa., has resigned to become general manager of sales of the Edgecomb Steel Company, offices at Philadelphia.

The General Office of E. I. du Pont de Nemours & Co., of which A. E. Pratt is manager, and the eastern office, of which F. H. Crawford is manager of the transportation sales department, have been moved from Parlin, N. J., to 1616 Walnut street, Philadelphia, Pa. The transportation sales department handles the sale of Duco, Dulux and paint and varnish products to steam railroads, electric railways and the marine industry. No change has been made in the New York and Chicago offices.

The Westinghouse Electric & Manufacturing Company plans to make improvements to cost over $300,000 at its South Philadelphia, Pa., works. The company contemplates alterations and additions to include the conversion of part of the manufacturing space into a new shop, where all locomotive equipping and testing activity in connection with Westinghouse oil-electric and electric locomotives will be concentrated. The plans also call for laying one and one-half miles of additional railroad track involving the handling of more than 12,000 cu. yd. of material in connection with new construction within the plant area; in connection with the Pennsylvania Railroad and the City of Philadelphia, the electrification, relocation and regrading of four miles of trackage to be used as a high-speed test track will be carried out.

Obituary

Walter Ross Gravener, southeastern sales manager of the American Steel Foundries, Washington, D. C., died on November 21. Mr. Gravener was born on January 25, 1872 at Ludlow, Ky., and was educated in Palatka, Fla., public schools. He began work as clerk in the office of the superintendent of motive power on the Plant System Railroad,

Walter Ross Gravener

(now a part of the Atlantic Coast Line) about 1890. He left the Plant System in 1900 and became associated with the American Steel Castings Company at New York. In the formation of the American Steel Foundries about 1903, the American Steel Castings Company was included and Mr. Gravener became associated with the American Steel Foundries as salesman in the New York office. He moved to Washington in 1905 and opened the office there as sales agent handling the southeastern territory. Mr. Gravener was appointed southeastern sales manager in November, 1929.

James A. Murray, eastern manager of the Ajax Manufacturing Company of Cleveland, Ohio, died on December 23.

Henry Harnischfeger, president of the Harnischfeger Corporation, Milwaukee, Wis., died on November 15.

A. W. Willcuts, assistant manager of the railroad sales department of Joseph T. Ryerson & Son, Inc., with headquarters at St. Louis, Mo., died on December 14 from heart failure.

(*Continued on second left-hand page*)

Domestic Orders Reported During December, 1930

Name of Company	Number ordered	Type	Builder
Locomotives			
Reading	10	2-10-2	Baldwin Loco. Wks.
New York Central	40	4-6-4	American Loco. Wks.
	10	4-6-4	Lima Loco. Wks.
Total for December, 1930	60		
Freight Cars			
Carnegie Steel Company	30	Gondola	American Car & Fdy.
	20	Flat	Pressed Steel Car Co.
	18	Flat	Standard Steel Car Corp.
Atchison, Topeka & Santa Fe	500	Refrigerator	Pullman Car & Fdy.
	350	Box	Pressed Steel Car Co.
	300	Box	General American Car
	300	Box	American Car & Fdy.
Missouri-Kansas-Texas	25	Caboose	Company Shops
City of Chicago	1	Hopper	Mt. Vernon Car Mfg.
North American Car Corporation	50	Refrigerator	Company Shops
Atchison, Topeka & Santa Fe	22	Caboose	American Car & Fdy.
	50	Box	General American Car
Sanitary District of Chicago	25	Dump	Western Wheeled Scraper Co.
Total for December, 1930	1691		
Passenger Cars			
Atchison, Topeka & Santa Fe	2	Cafe	Pullman Car & Mfg. Corp.
Total for December, 1930	2		

Personal Mention

General

R. W. Brown, general superintendent of the eastern lines of the Baltimore & Ohio, has been appointed general manager of the Central of New Jersey, with headquarters at Jersey City, N. J. Mr. Brown was born on August 5, 1883, at

R. W. Brown

Carlyle, Ill., and was educated in the elementary schools of that city. He began railroad service as a laborer on the Baltimore & Ohio in July, 1901, becoming a fireman in 1902 and engineman in 1905; then air brake instructor and in 1910, assistant road foreman of engines. In January, 1914, he was appointed supervisor, locomotive operation; in June, 1915, trainmaster, and in October, 1917, assistant superintendent. He became superintendent of the Ohio division at Chillicothe, Ohio, in September, 1919; in October, 1921, was transferred to the Connellsville division, and in June, 1923, transferred to the Cumberland division in the same capacity. In January, 1926, he was appointed general superintendent of the eastern lines of the Baltimore & Ohio.

C. M. Shriver, superintendent of Baltimore terminals, of the Baltimore & Ohio,

C. M. Shriver

has been appointed superintendent of the Baltimore division. Mr. Shriver, who was born in Baltimore, Md., on January 9, 1893, and received his education in the Boys Latin School at Baltimore, and at Lehigh University, entered railway service in 1912, as a machinist apprentice with the Baltimore & Ohio. In July, 1915, he was appointed machinist and from January to April, 1916, he served in the capacity of inspector of fuel service. He became assistant road foreman of engines in April, 1916; in March, 1917, assistant trainmaster, and in May, 1917, trainmaster. From July, 1918, to May, 1919, Mr. Shriver was furloughed for military service, returning to the B. & O. as trainmaster in 1919. In July, 1920, he was appointed assistant superintendent of the Baltimore terminals, and in 1921, superintendent.

Michael A. Smith, superintendent of motive power of the Pittsburgh & Lake Erie and Lake Erie and Eastern, has been appointed general manager. Mr. Smith was born in Norwalk, Ohio, on September 7, 1872, and was educated in the public schools of Norwalk. He entered the service of the Wheeling & Lake Erie as a locomotive fireman on August 29, 1890, and was advanced to locomotive engineer

Michael A. Smith

in 1896. Mr. Smith left the service of the Wheeling & Lake Erie in 1899, and in March, 1900, entered the service of the Pittsburgh & Lake Erie as a locomotive inspector, serving in that capacity until June, 1901. From the latter date until November, 1902, he was traveling fireman, and then served as enginehouse foreman until June, 1904. Mr. Smith then became general foreman at the Glassport shops which position he held until December, 1912, when he was transferred in the same capacity to the East Youngstown shops, where he remained until September, 1917. From September, 1917, until June, 1923, he served as trainmaster, and in September, 1927, became assistant superintendent of motive power.

Harry L. Worman, superintendent of motive power of the St. Louis-San Francisco, with headquarters at Springfield, Mo., has been elected vice-president in charge of operation, with headquarters at St. Louis, Mo. Mr. Worman has been in railway service for 32 years, 25 of which have been in the mechanical department of the Frisco. He was born at Salem, Ohio, on July 19, 1881, and obtained his first railroad experience as an enginehouse helper on the Kansas City Southern at Kansas City, Mo., in 1898. Later in the same year he became a machinist

Harry L. Worman

apprentice and in 1902 was advanced to machinist, leaving the Kansas City Southern in 1903 to become a pressman for the Kansas City Star. He entered Frisco service in 1905 as a machinist at Kansas City, then serving successively on that road as enginehouse foreman at Kansas City, erecting foreman, machine foreman and general foreman at Scott, Kan., and traveling enginehouse foreman and master mechanic at Memphis, Tenn. In 1919 Mr. Worman was promoted to the position of assistant superintendent of motive power, with headquarters at Springfield, his promotion to superintendent of motive power becoming effective in November, 1920.

Karl Berg, who has been appointed superintendent of motive power of the

Karl Berg

Pittsburgh & Lake Erie and Lake Erie & Eastern, as announced in the December issue of the *Railway Mechanical Engineer*, was born in Sweden in December, 1881. He was educated in the public schools of Sweden and attended the New York Central apprentice school while serving as an apprentice. After completing the ap-

(Continued on next left-hand page)

Railway Mechanical Engineer

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Railway
Mechanical Engineer

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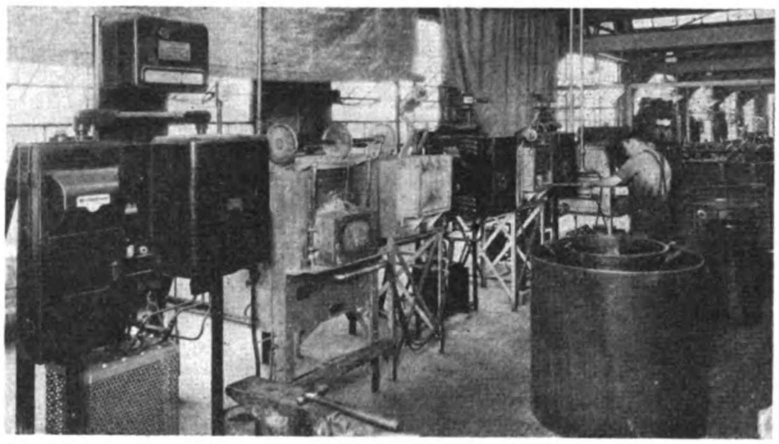
February - 1931

Industrial Electric Heating For Railway Shops*

By Wirt S. Scott†

A study of electrical heating equipment in use in the Norfolk & Western shops at Roanoke, Va., with costs of operation and savings effected by its use



Heat-treating department for small tools

ALTHOUGH the use of electricity for heat treating has extended to many industries, comparatively little was known until recently of the steam-railway industry's attitude towards the use of electric heat for this purpose. For this reason it was decided to make a study of the economic value of electrical-heating equipment in the Norfolk & Western Shops at Roanoke, Va., these shops being selected for such an analysis because electricity is widely used there for heating purposes.

Equipment of many different manufacturers is represented at the Roanoke Shops. Irrespective of the kind, type or make of the equipment used, an attempt was made to determine in a concrete manner the advantage of such equipment in comparison to past practice. All of the equipment was found to be giving a good account of itself and the repairs to it have been negligible. The following table contains a list of the equipment which was studied to obtain comparative cost data.

The Roanoke shops are not completely electrified, the Norfolk & Western's problem being similar to that of other companies, i.e., financing the expenditure. From

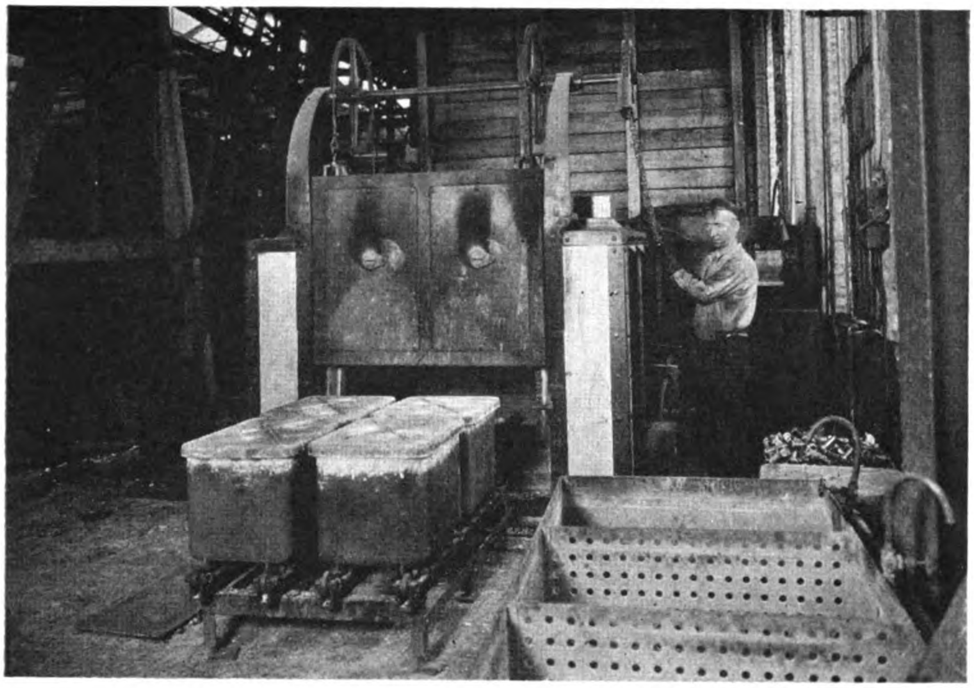
Electrical Heating Equipment Used in the Norfolk & Western Shops at Roanoke, Va.

Babbitting department	102 kw.
1—50-kw. melting pot for melting down old bearings	
1—30-kw. tinning pot for brasses	
1—22-kw. babbit melting pot	
Electrical department	30 kw.
1—30-kw. armature baking oven	
Tool department	51 kw.
1—8-kw. preheating and tempering furnace.	
1—13-kw. hardening furnace, carbon steel	
1—30-kw. hardening furnace, high-speed steel	
Forge department	240 kw.
2—120-kw. carburizing furnaces	
Core-making department	555 kw.
3—185-kw. core-baking ovens	
Foundry	540 kw.
1—540-kw. annealing furnace	
Additional Equipment	
1—Steel melting furnace	1,000 kw.
1—Rivet heater	30 kw
Miscellaneous glue pots	5 kw.
Crane cab heaters	10 kw.
Total Connected Load	2,563 kw.

the study of the equipment installed, however, it has been determined that electric heating is economical, ac-

* This article will appear in two parts. The concluding part will appear in the March issue.

† The author is Special Representative of the Westinghouse Electric & Manufacturing Company.



One of the 120-kw. carburizing furnaces — Approximately 1,500 lb. of carburized parts are obtained per charge with an average production of 2 lb. per kw.-hr. at a cost of $0.004 per lb.

curate, dependable, and that the following advantages are obtained:

1—Uniformity of heating
2—Ease of control
3—Continuity of operation
4—Quality of product
5—Speed of production
6—Maintenance
7—Confidence in the heating process.
8—Removal of uncertainty in the manufacturing process
9—A dependable and uniform-quality product
10—Greatly improved working conditions

Tool Heat-Treating Department

In this department are heat treated the high-speed and carbon-steel tools such as are used in many large machine shops where a wide variety of work is being done, particularly on heavy parts. The furnace equipment includes a preheating furnace for high-speed steel; a hardening furnace for carbon steel which is also used for preheating high-speed steel at temperatures between 1,400 and 1,650 deg. F., and for tempering alloy steel, and a furnace for hardening high-speed steel at 2,250 deg. F. The preheating furnace is also used as a tempering furnace. The size, capacity and range of these furnaces are as follows:

PREHEATING FURNACE
Hearth area: 12 in. by 22 in. by 8 in. high
Electrical capacity: 8 kw., 1 phase, 110 volts
Range of operation: 400 deg. F. to 1,850 deg. F.

HARDENING CARBON STEEL
Hearth area: 12 in. by 28 in. by 8 in. high
Electrical capacity: 13 kw., 1 phase, 220 volts
Range of operation; 1,000 deg. F. to 1,850 deg. F.

HARDENING HIGH-SPEED STEEL
Hearth area: 10 in. by 18 in. by 6 in. high
Electrical capacity: 30 kw. 220 volts
Range of operation: 2,000 deg. F. to 2,500 deg. F.

The operation of heat treating high-speed steel blanks ¼-in. by 1-in. by 6-in. consists of placing them in the 8-kw. furnace at a temperature of 1,000 deg. F., and soaking them for one hour; removing and placing the blanks in the 13-kw. furnace at a temperature of 1,600 deg. F., and soaking them for one-half hour; removing and placing them in the 30-kw. high-speed-steel hardening furnace at a temperature of 2,250 deg. F., for 5 min. The furnaces in this manner are operated at the maximum production capacity, the highest efficiency, and the greatest refinement of the steel and the elimination of heating strains are effected.

Chrome-steel die blocks are hardened at 1,600 deg. F., quenched in oil, tempered at 950 deg. F., and cooled in air. Shear blades are hardened at 1,450 deg. F., quenched in water, and tempered at 420 deg. F. Insert blades for reamers are hardened at 2,250 deg. F., quenched in oil, and tempered at 1,050 deg. F., and cooled in air.

The heat treater in charge of these furnaces reports that since the adoption of electric heat, all guesswork has been eliminated. Experience has taught him that the heating characteristics of the electric furnaces are such that they become definite, with the result that, for each piece heat-treated, a definite time can be allowed for complete saturation. This procedure, supplemented by uniformity of chamber temperature and automatic temperature control, has completely revolutionized methods of operation and results. It is no longer necessary to watch the work, and to attempt to judge by its color if and when properly heated.

The exactness of heat treatment has been reflected in the increased life of the tools, a natural consequence. Since all the tools pass through the tool-grinding department, an investigation was undertaken to determine the tangible results of electric heat treatment. A record was secured in connection with high-speed steel tools, showing that the tool cost has decreased 25 per cent, and that the life has increased one-third. There are 11 men in the grinding department as follows: three men on new work exclusively, two men grinding milling cutters, and five men who spend 75 per cent of their time on old tools and the balance on new tools. The present hourly cost for refinishing tools is $4.21, based on two men at 80c per hr. or $1.60, and 75 per cent of five men's time, or $2.61. One-third of $4.21, or $1.40 is thus saved per hour in labor, or $291.20 per month.

The records also show that at present an average of 1,400 lb. of tool steel are worked up per month, at a cost of 60 cents a pound, or a total purchase price of $840. With the tools lasting one-third longer, since using electric heat, the saving based upon present operating conditions is $280 per month. The total saving is therefore $571.20 per month.

A rough estimate was made as to the monthly power consumption of the three electric furnaces, based upon

The 540-kw. car-type furnace for normalizing steel castings — It operates from four to five nights a week with a consumption of from 400 to 500 kw.-hr. per ton of castings

observed operating conditions over a period of four days. Such computation showed an estimated monthly consumption of 6,250 kw.-hr. which would cost, at an 8-mill rate, exactly $50 a month.

The investigation was extended to the machine shop for the purpose of determining whether or not the machinists have observed any difference in the life of tools. The older and more experienced men reported increased life anywhere from 30 per cent to 50 per cent. In turning steel axles, for instance, the workmen report that they are now getting a 4-ft. cut compared with a 3-ft. cut which was considered a very high average in the past.

Carburizing Furnaces

In the maintenance of locomotives, there are a large number of parts to be carburized, such as wrist pins and bushings, equalizer bushings, split side-rod bushings, brake pins, spring-rigging pins, knuckle pins, die blocks and die-block pins. All of these parts are placed in nickel-chromium carburizing boxes, and packed with crushed bone.

The parts are made of low-carbon steel so as to give maximum toughness, and then given a high-carbon case, 3/64-in. thick for maximum surface wear. The heat treating is done at a temperature of 1,650 deg. F. Two electric furnaces are available, each having a rating of 120 kw. capacity, with an effective hearth area 42 in. wide, 56 in. long and 20 in. high.

These furnaces are of the roller-hearth type, with the rollers extending about 6 ft. outside the furnace, so the boxes may be packed in position and rolled into the furnace. This operation requires the services of two men. Two different size boxes are used, one 16 in. by 22 in. by 18 in. high and another 16 in. by 50 in. by 18 in. high. Two large boxes, or four small boxes, or one large and two small boxes constitutes one charge.

The furnace is charged every afternoon at 5 p. m. Usually from 12 to 16 hours are required per heat, depending upon the weight of charge. An average charge will weigh from 1,400 to 1,500 lb. net of material to be carburized, 1,100 to 1,200 lb. of carburizing boxes, and approximately 500 lb. of crushed bone.

A test was made on one of the furnaces to determine the heating characteristics and power consumption. The furnace was charged with 980 pieces of work totaling 1,436 lb.; carburizing boxes, weighing 1,148 lb, and crushed bone, weighing 505 lb., a total gross weight of 3,089 lb. Other data and results of this test are as follows:

Furnace temperature at start	860 deg. F.
Operating temperature	1,650 deg. F.
Time in	5 P.M.
Time out	6:10 A.M.
Time for furnace thermocouples to reach 1,650 deg. F.	2 hr. 45 min.
Time furnace is held at 1,650 deg. F.	10 hr. 25 min.
Total time	13 hr. 10 min.
Kw.-hr. consumed in reaching 1,650 deg. F.	328
Kw.-hr. consumed after reaching 1,650 deg. F.	400
Total kw.-hr. consumed	728
Gross pounds of material per kw.-hr.	4.25
Net pounds of work carburized per kw-hr.	1.97
Cost of power per charge, at 0.8 cent per kw.-hr.	$5.828
Net cost of power per pound of material carburized	$0.00406

Tests made on carburized parts show a remarkable uniformity of case regardless of the location of the part in the furnace or in the box. With fuel-fired furnaces, absolute dependence could never be placed on the product, since in some parts of the furnace the case of the product would be less than one-half of that in other parts, and the heat treatment was largely a matter of guesswork and compromise of results. With the electric furnace, the operation has become one of timing, so that with a certain charge, the foreman knows how long a period will be required for obtaining a definite penetration, with the assurance that the penetration will be the same throughout the entire charge.

Because of the much greater exactness of heat treatment resulting from the use of the electric furnace, it is estimated that the useful life of many of the major pieces of all the carburized parts has been more than doubled. This has resulted in less replacements of such worn parts, a very substantial saving.

Cold-rolled steel bushings average 29.32 cents per pound finished, and ready for application, including material, labor, shop expense and stores expense. The labor cost for installation averages 20 cents.

Brake and spring-rigging pins average 8.77 cents per pound, finished and placed in stock. No additional charge can be added for labor of replacement, since these pins must be removed for periodic inspection, and are then replaced if they show too much wear.

On the basis of 20 charges a month, and 1,450 lb. of

material per charge, 29,000 lb. will be heat treated per month, which will be made up of approximately 9,000 lb. of bushings, 18,000 lb. of pins, and 2,000 lb. of miscellaneous products. The values of these parts are as follows:

9,000 lb. bushing at 29.32 cents per lb. for manufacturing....	$2,628.80
9,000 lb. bushings at 20 cents per lb. for installation........	1,800.00
18,000 lb. pins at 8.77 cents per lb. for manufacturing........	1,578.60
Total value per month..................................	$6,007.40

Twenty-five per cent of $6,007.40 or roughly $1,500 per month represents the minimum net savings since using electric heat, for pins and bushings. The cost of heat treating these parts, a total of 27,000 lb. is $109.02. With a saving by extended life on the remaining 2,000 lb. of miscellaneous parts in proportion to that of pins and bushings, the total monthly savings and expense will be $1,560 and $117.74, respectively.

The savings in the above case is 13 times the cost of electric power. That the life of the carburized parts has been increased is also shown by the fact that one electric furnace is now handling the repair parts for which two were originally required.

Annealing Steel Castings

A coke-fired furnace was first installed at the Roanoke Shops for the heat-treatment of steel castings, then this furnace was replaced with one heated with oil. Whenever the doors of the coke furnace were opened to add more fuel, the temperature within the furnace chamber would drop from 75 deg. to 100 deg. With the oil fired furnace, a series of tests disclosed the fact that the temperature at all parts within the furnace were nowhere near the same, with the result that a great non-uniformity of physical properties was disclosed even within the same castings. A casting with many heavy sections may have one such section located either in a cold area or in a part which is slow to come up to heat, so that the surrounding temperature may be either too low, or not of sufficient duration to permit thorough penetration.

Test samples only indicate the conditions at the point of the sample. One foot away, an entirely different result may be secured. Obviously there was no system of inspection and testing that would insure a 100 per cent properly heat-treated product in a furnace heated by a high-temperature flame and convection currents. No two burners will produce exactly the same amount of heat, the heating is done more or less in spots, and is not capable of being uniformly distributed and controlled in a manner which will insure every part of every casting being properly heat treated.

A decision was made to replace the oil-fired furnace with an electric furnace, solely on the basis of producing the kind of casting having the physical properties desired. The electric annealing furnace was installed in 1927, at a total cost of $16,500. It has an electrical capacity of 540 kw., a maximum charge capacity of 20 tons, an average capacity of 12 tons, and a loading space on the car 7 ft. wide, 14 ft. long and 5 ft. high.

This furnace was charged with a test load of 13 tons, consisting of miscellaneous car castings and the following:

1—Engine saddle..........................	3000 lb.
1—Front foot plate........................	1800 lb.
2—Driving boxes..........................	600 lb.
1—Grate rest.............................	1565 lb.
1—Driving wheel..........................	2500 lb.
1—Back cylinder head.....................	600 lb.
2—Driving boxes, oversize................	950 lb.
3—Front cylinder heads...................	500 lb.
2—Chafing blocks.........................	200 lb.
4—Truck boxes............................	150 lb.
4—Valve-head extensions..................	325 lb.

All of the above castings were given a normalizing heat treatment, which consists in heating the castings at a temperature of 1,650 deg. F., until thoroughly saturated, and then pulling the car out into the air for an air quench. The electric furnace heats uniformly top and bottom, end to end, and by allowing one hour soaking period per inch of the heaviest cross section of the casting, from the time the temperature of 1,650 deg. is reached, it has been found that the entire charge will be thoroughly heated.

The car-type furnace is operated from four to five nights each week. With a charge as above described, the furnace will require 9 hr. to reach 1,650 deg. F., and the temperature held at 1,650 deg. F., for 6 hr., making a 15-hr. heating cycle.

Some parts, such as engine frames, are given a double heat treatment for the purpose of giving such members greater ductility. This consists in heating the charge at 1,650 deg. F., for 10 hr., remove and allow to cool until black, reheat to 1,250 deg. F., for 10 hr., and remove into the air.

In addition to securing a properly annealed casting, the outstanding result was the decreased cost of machining the castings. Workmen in the machine shop praised the electric annealing furnace very highly. It is very seldom that a hard spot is now encountered, the breakage of tools is much less, more cuts are obtainable, and the steel has a much better grain or texture.

As near as could be determined, the machining costs have been decreased 10 per cent since electrically annealing the castings. There are a total of 250 machinists, 50 per cent of whom work on steel castings. At an 80-cent hourly rate, the hourly cost for machining these castings would be $100 or a monthly cost of $20,800. Since it has been estimated that the savings over previous cost is 10 per cent and the previous cost, based on present production, was $23,200, the net monthly savings in labor for machining would be about $2,400.

Power Consumption

For a 13-ton charge, with the furnace started cold, or approximately so (the current having been cut off for 32 hours), the power consumption was as follows:

Power required to reach 1,650 deg. F....................	4,860 kw.-hr.
Power required after reaching 1,650 deg. F...............	1,620 kw.-hr.
Total power required.....................................	6,480 kw.-hr.
Consumption per ton......................................	500 kw.-hr.

A consumption of 500 kw.-hr. per ton is much higher than the average, since this figure was based on a test in which the furnace was not used the preceding night. In addition, the furnace door was held open for a considerable portion of the time in arranging for photographs of the charge prior to heat treatment. The furnace ordinarily would have come up to operating temperature in 7 hours with a total consumption of 5,400 kw.-hr. or 415 kw.-hr. per ton of steel castings.

A second test charge was heat treated, the charge weighing 20 tons and consisting of very heavy castings, such as locomotive driving wheels and frames. The operating data of this charge is as follows:

Total weight of charge................................	40,210 lb.
Time required to heat charge from atmospheric temperature to 1,650 deg. F....	11 hr. 15 min.
Time required for soaking charge at 1,650 deg. F.......	9 hr.
Total time of heating cycle............................	20 hr. 15 min.
Power for heating up charge (11¼ hr. at 512 kw. per hr.)	5,760 kw.-hr.
Total power used.......................................	7,760 kw.-hr.
Kw.-hrs. for soaking charge............................	2,000
Total lb. annealed per kw.-hr..........................	3.18
Kw.-hr. per ton..	392

Assuming a conservative estimate of 450 kw.-hr. per ton on a monthly basis of a production of 170 tons of steel casting annealed, the operating cost would be as follows:

(Concluded on page 65)

Air-Conditioning Requirements For Railway Passenger Cars*

By A. H. Candee†

A presentation of the various problems surrounding the uses of conditioned air for passenger equipment. The author herein discusses the requirements of the equipment as a whole and the advantages and short comings of different refrigerating methods and energy sources

IT is recognized that air cooling and conditioning of most of the railway passenger equipment is inevitable, once it has been shown to be practicable. Those who have had occasion to travel on the railroads in the summer time or who have entered a sleeping car which has been occupied for some time will appreciate the comfort of clean, fresh air at the right temperature. The railroads also recognize the importance of this as a means of attracting the traveling public, which is showing a marked tendency to travel by automobile, bus, or airplane rather than by rail.

The two air-conditioned cars in operation at present are in the nature of trial installations.‡ They are demonstrating the feasibility of applying refrigerating plants to railway cars for cooling purposes, but the heating systems of the cars have been unchanged. The ultimate equipment will undoubtedly have the heating system modified at the time refrigerating equipment is applied, so that the temperature of a car may be controlled at all times by the addition of heat to, or the extraction of heat from, the circulated ventilating air.

Air conditioning may be divided into three general phases:

1. Supply and circulation of cleaned fresh air.
2. Control of temperature of the air.
3. Humidity control.

For the immediate future, it is doubtful whether there will be any attempt to control closely the humidity of the air within a car because of the complications involved and the lack of space for equipment and water supply. The band of comfort to passengers is so broad that it is entirely feasible to adjust the air temperature to maintain comfortable conditions. Thus, in the winter time, a passenger will feel just as comfortable at a relative humidity of 10 per cent and an air temperature of 72 F. as at a relative humidity of 50 per cent and an air temperature of 68 F. This means that while the thermostatic temperature control will be used normally, it is advisable for the train crew to have some manual adjustment of all controlled temperatures within the cars of the train, to compensate for variations in atmospheric humidity. Such thermostatic control must permit of practically constant temperature during cold weather, but must allow of a rising interior car temperature as the exterior temperature rises, for the spread between the two should seldom exceed 15 deg. (dry-bulb), or the effect on passengers is likely to be unpleasant. The preferable differentials in temperature with average external humidity are shown by Table 1.

* Abstract of a paper presented before the American Society of Heating and Ventilating Engineers at Pittsburgh, Pa., on January 27, 1931.

† Railway Engineer, Westinghouse Manufacturing Company.

‡ The Baltimore & Ohio installation is described in the *Railway Mechanical Engineer* of September, 1930, page 508. The Santa Fe installation is described in the December 1930, issue, page 696.

Basis of Air Conditioning Railway Cars

One of the greatest advantages of any system of air conditioning is the provision of clean fresh air for the passengers. The opening of passenger car windows is usually accompanied by a swirl of cinders, soot, and smoke yet at present one cannot travel in the summer time without having them open. The basis of air conditioning must, therefore, be to have all windows closed and locked, and to draw the ventilating air through a cleaning device of some sort which will exclude the dirt and dust, after which it must be properly circulated within the car to provide equal distribution without excessive drafts. Sealed double-sash windows, improved insulation, and elimination of ventilators and bracket fans will no doubt be features of the air-conditioned car. This will also make a quieter car, as external noises will be more effectually excluded.

Table I—Preferred Interior Temperature Regulation (Exterior Temperatures above 70 Deg. F.)

External Temp. F.	Interior Dry-Bulb Temp. F.	Interior Wet-Bulb Temp. F.	Effective Temp. F.
95	80	65.2	73.4
90	78	64.5	72.2
85	76.5	64.0	71.1
80	75	63.5	70.2
75	73.5	63.0	69.3
70	72	62.5	68.2

It is not possible to locate an air intake in a railway car where clean air from the outside is insured. It is, therefore, necessary to remove the cinders, dust and dirt by artificial means, such as an air washer or a dry type of filter. While the former has the advantage of being a cooling medium and a means of controlling the humidity, the space required is a serious handicap in a great many cars. The dry type of filter will probably be used, if an air washer cannot be applied, and may even be used in series with the air washer to remove the larger particles from the air stream. Any dry type unit must be located for easy removal for cleaning purposes. It appears that the cleanest air may be obtained high in the car, near the roof. The two existing installations previously mentioned draw in air through the vertical walls of the clerestory just above the half deck of the car, where deck ventilators are normally placed.

The amount of air circulated per minute per pas-

senger in a railway car equipped with air conditioning apparatus will vary somewhat with the particular type of car. It is clearly necessary to recirculate a portion of the air in order to reduce plant capacity required for heating or cooling purposes where limited power and space are available, and the amount of fresh air drawn from the exterior of the car will vary with atmospheric conditions and with the application. It is obvious that a dining car must have more fresh air supplied (on account of pollution due to kitchen smoke and odors) than a parlor car, and that a smoker must have considerable fresh air in order to clarify the interior atmosphere. This indicates the desirability of selective variation in the ratio of incoming fresh air to circulated air. While railway ventilation practice in the past has generally been based on 15 cu. ft. of air per minute per passenger, it is expected that forced circulation and careful distribution of the air will reduce this figure somewhat. Table 2 is submitted as a guide in determining required air circulation for different passenger compartments. On the basis of 15 cu. ft. per minute per passenger, it would be necessary to change the air in a coach every three minutes, in a sleeper every four minutes, in a parlor car every nine minutes, and in a diner every five minutes as a maximum. However, since air movement assists in improving the comfort of a cooled car, it is desirable to circulate the air at a faster rate than this in the summer itme, reducing the fan speed and delivery for cold weather conditions.

Table II—Approximate Data For Passenger Compartments

	Length Compartment (Feet)	Floor Area (Sq. Ft.)	Interior Volume (Cu. Ft.)	Maximum Seating Capacity	Volume Per Passenger (Cu. Ft.)
Coach	58	522	4060	100	40
Sleeper	37½	337	2740	48	57
Parlor Car	46	414	3360	26	130
Diner	39	350	2850	36	80
Smoking Room	10	65	540	6	90
Drawing Room	7	43	380	5	76

From the foregoing discussion, it will be apparent that the essentials of the air circulating system include one or more air filters equipped with manually-operated shutters which may be adjusted at will, or completely closed in passing through tunnels, a circulating fan (preferably of variable manual speed control), and a suitable duct system for proper distribution of the air throughout the car and for recirculation of a portion of that air. The amount of air allowed to escape from the interior must be equal to that introduced, and with a sealed car will mean the provision of a variable vent.

Location of Heating and Cooling Units

With an air circulating system provided on a car, the best temperature control may be effected by placing both the heating and the cooling units directly in the ventilating air stream, preferably close to the fan, adding or subtracting heat as required. The location of the heating coils in this way will improve the efficiency of heat transfer and save in cost and weight over the present system of extending steam pipes along the sides of a car near the floor. The fact that it may be necessary to circulate both the heated and the cooled air through the car in the same direction will probably be unimportant in the face of practical considerations.

Steam, generated at the locomotive, has long been the source of heat for maintaining comfortable temperatures within a train in cold weather, although this inflicts a severe handicap on motive power with low ambient temperatures. An ordinary coach having a 70-ft passenger compartment requires nearly 100 hp. from the locomotive for heating under the maximum conditions in zero weather, which means that approximately half as much energy is used for heating as for train propulsion under these conditions. It is undesirable to draw power from the locomotive for auxiliary purposes if it can be avoided in any way, but the use of steam for heating cannot easily be discarded.

Methods of Cooling

For the cooling of cars in hot weather, means must be arranged for passing the ventilating air over a cold body in order to extract heat. There are three general systems available for providing such a cold body:

1.—A material having heat-absorbing characteristics, such as ice.

2.—An absorption system of mechanical refrigeration.

3.—A compressor system of mechanical refrigeration.

Differentiation between the absorption system and the compressor system has been made on account of the fact that the one employs heat direct, while the other requires mechanical energy. In considering their application to railway cars, this may be of considerable importance.

Any refrigerating method should be carefully considered from a practical standpoint, weighing the relative effects of practicability, reliability, weight, first cost, and operating expense. It may be used a maximum of 50 days a year, yet it must ride with the car for the other 315. The air circulating system, however, is used the year round.

The refrigerating system must be safe, above all else, allowing no escape of fumes within the car and no danger of explosion even in case of accident to the car. The weight, first cost, and operating expense are economic factors and must be justified on the basis of an increase in revenue, for the railroads cannot continue to provide additional comforts for the traveling public unless these comforts show returns in increased passenger traffic or unless the fare per passenger is increased.

The most common method of providing heat absorption capacity is by the use of ice. It is estimated that from one to two tons of ice will keep a car cool for at least a day under the most severe conditions if the melting is properly controlled. Such a method of refrigeration, however, requires daily recharging of the ice boxes, but compared with mechanical refrigeration, the apparatus carried on the car is simple.

Absorption systems are available for maintaining low temperatures in refrigerator cars, but the development has not yet progressed to a point where they may be applied to the air conditioning of passenger cars. The fact that heat is used in place of mechanical energy offers very attractive possibilities, as the fuel may be carried on the car itself, and may be replenished with little difficulty. It is expected that new developments in this field will be announced shortly, which will simplify the application of refrigerating systems to railway cars.

It is logical that the first air-conditioned cars should employ mechanical refrigeration, as this field has had the advantage of considerable development. The question of power supply, however, is troublesome and together with the refrigerating mechanism adds considerable to the weight and cost of a car.

There are six general methods of providing the energy required for a mechanical refrigerating system (excluding the absorption system):

1.—Steam power plant on each car.

2.—Steam power plan on or near the locomotive.

3.—Internal combustion engine power plant on each car.

4.—Internal combustion engine power plant on the locomotive or in a baggage car.

5.—Axle driven generator on each car.

6.—Axle driven generator on each car supplemented by a storage battery.

It will be noted that in methods (1), (2), (5) and (6) the energy is obtained by subtraction from the motive power, except in cases where steam may be generated in a separate boiler such as is used in connection with an electric locomotive. Method (3) renders a car independent of movement of connected motive power. With method (5) energy is supplied only when the train is in motion and it is to overcome this handicap that method (6) was devised. The Baltimore and Ohio diner employed method (5), and the Santa Fe, method (6), but alterations in the former have been made so that the cooling water pump and the ventilating fans now operate from the battery and thus continue the cooling while the car is standing for short periods. Schemes such as (2) and (4) require that electric power circuits be carried the length of the train. While such a distribution system cannot be applied in the immediate future, due to the fact that it is an immense task to apply such conductors to the number of cars involved, it is obvious that the electrical comforts and conveniences such as are found in a great many homes will ultimately be available to the railroad traveler and that this will require a dependable power system. Some of the most prominent railway electrical engineers forecast the use of such power generation and distribution on trains, with the consequent elimination of the troublesome axle-driven generators and storage batteries now in use.

For the immediate future, therefore, it may be assumed that there are several practical methods of obtaining a cold body, namely, ice carried in an insulated compartment and melted as required; absorption systems of refrigeration using a stored liquid, gaseous or solid fuel supply which may be replenished at will; a steam or internal-combustion engine-driven mechanical refrigerating plant; or equipment using an axle generator as the means of utilizing motion of the car for transmitting energy from the locomotive. Although the diners now in operation utilize axle generators, it is doubtful whether this practice will continue.

Calculations indicate that from 60,000 to 80,000 B.t.u. per hour maximum must be absorbed in order to provide effective cooling of a diner or a sleeping car. Experience has shown that this requires an input of from 10 to 13 hp. to a refrigerating plant of the mechanical type. The heat to be extracted is calculated as shown by Table 3, making due allowance for improvements in

Table III—Calculation of Heat Extraction For A Sleeping Car*

	B.t.u. per hour
Heat through car walls	11,000
Solar radiation	10,000
Heat from make-up air	30,000
Passenger radiation (300 B.t.u. per hour per passenger (48) passenger maximum)	14,400
Power of blower	1,500
Loss in pipe lines	2,000
Total	68,900

* Based on following conditions: External temperature, 95 F.; internal temperature, 80 F.; time, 2:00 to 4:00 P.M.; average train speed, 30 m.p.h.; maximum conditions.

insulation of the car. Any mechanical system of cooling must have a capacity equal to the short time demand such as is indicated in Table 3, but the total capacity of any system using heat absorbing material, such as ice, may be based on an integration of the demands throughout the complete run of the car between recharging stations.

Problems to Be Solved

There are a great many problems to be solved. Who is now able to forecast the best method of refrigerating, of arranging units, of supplying energy, and of insulating cars? These questions can be answered only by experience, and trial installations such as have been made have already advanced the available knowledge considerably. It is highly probable that the resulting research will materially reduce the amount of steam used for heating, through the use of double windows fastened in place and carefully sealed, through different materials and methods of blanketing the car, and by better heat transmission from the steam pipes to the air. This factor alone, if accomplished, will represent a considerable saving to the railroads.

Many railroads are interested in air conditioning, but few feel that the weight, cost and complication of the present types of mechanical refrigerating units can be justified. It is one thing to apply such a system to a car, but it is an entirely different matter to train an organization, scattered over the country, in operation and maintenance so that the equipment will function continuously and efficiently. The problem is not alone that of the railroads, but involves the heating, ventilating and refrigerating engineers of the country, by whose efforts simple and reliable equipment can be developed. Preference will be given to those systems which employ the minimum number of working parts, the lowest operating expense, and a minimum of space.

Industrial Electric Heating For Railway Shops

(Continued from page 62)

Basic power cost per kw.-hr.	$0.008
Tons per month	170
Kw.-hr. per ton	450
Power cost per ton, average	$3.60
Power cost per month	**$612.00**

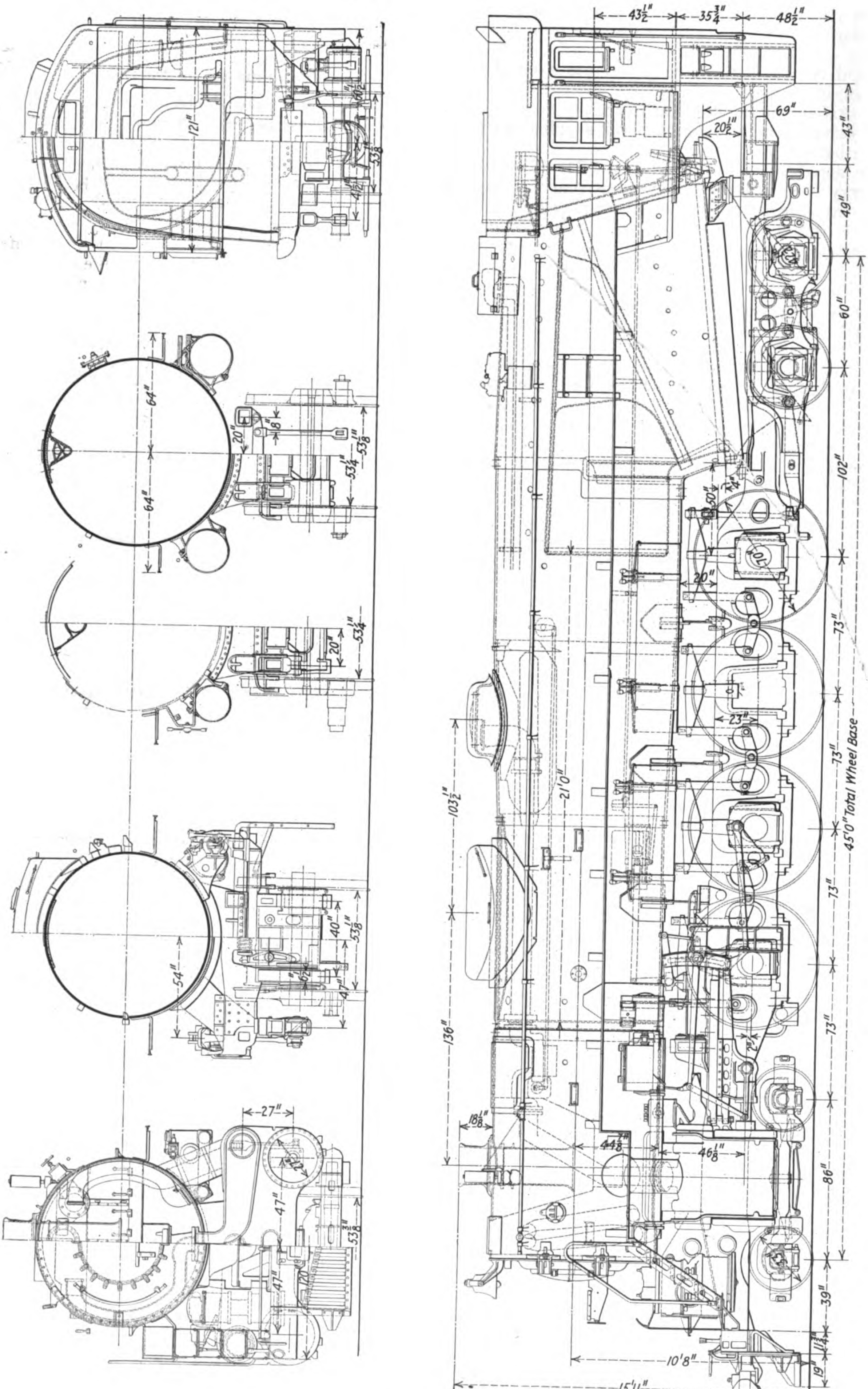
Using fuel-fired furnaces, it was necessary to have a man on duty continuously to look after the furnace. With electric heat, it has been possible to dispense with such help, since the only attention required is on the part of the night watchman, who punches a clock alongside the control panel for the electric furnace, and all he has to do is to note if the indicating lamps are burning. This saving in labor is $118.50 per month.

Summary

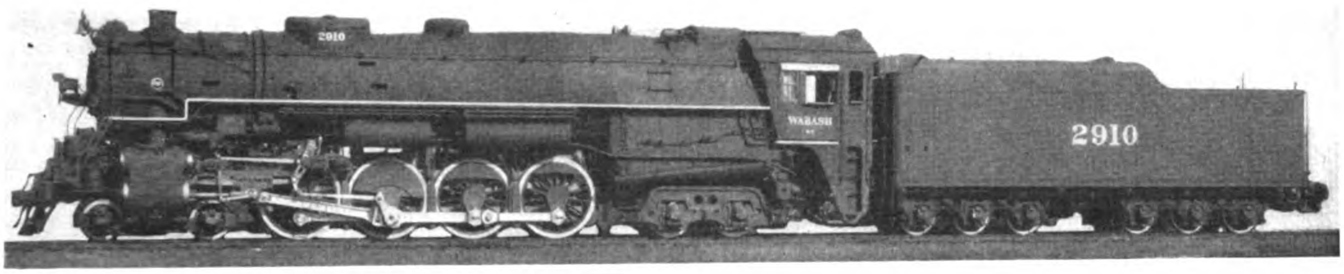
Monthly saving in machining of steel castings	$2,400.00
Monthly saving in labor of attending furnace	118.50
Total monthly saving	$2,518.50
Monthly cost of electric power	612.00

There is an additional saving not mentioned in the foregoing—that of breakage of tools on account of hitting of hard spots in the castings. There was no way of arriving at this saving except in a very vague manner. A great deal less trouble was being experienced, and as a matter of fact, it has just about been eliminated. As an indication of what this tool breakage, and additional grinding and wearing out of tools may amount to, the saving in tools, in one case analyzed, amounted to ten times the labor saving. This may have been an exceptional case, but it would seem that one could conservatively estimate the saving in tools would at least equal the saving in labor, for the entire shop.

(The conclusion of this article will appear in the March issue.—Editor.)



Elevation and cross sections of the Wabash 4-8-4 type locomotives built by Baldwin



Wabash 4-8-4 type locomotive built by the Baldwin Locomotive Works

Twenty-Five 4-8-4 Type Locomotives for the Wabash

Purchased to replace 4-8-2 types in through-freight service—Equipped with Type E superheater, feed-water heater, stoker, two Thermic syphons and power reverse —Tractive force, 70,750 lb.

THE Wabash recently placed in through-freight service 25 4-8-4 type locomotives which were built by the Baldwin Locomotive Works. These locomotives were purchased to replace 4-8-2 type locomotives operating between Decatur, Ill, and Montpelier, Ohio, a distance of 272 miles, with eastbound and westbound ruling grades of 0.6 and 0.9 per cent, respectively. The locomotives replaced developed a tractive force of 66,568 lb. The new power is somewhat similar in design to the 4-8-2 locomotives, except that the four-wheel trailing truck permitted a larger grate area (96.2 sq. ft.) than could be carried on a two-wheel trailing truck.

Table Showing the Principal Weights, Dimensions and Proportions of the Wabash 4-8-4 Type Freight Locomotives

Railroad	Wabash
Builder	Baldwin Locomotive Works
Type	4-8-4
Service	Freight
Cylinders, diameters and stroke	27 in. by 32 in.
Valve gear, type	Walschaert (20) Baker (5)
Valves, piston type, diameter	12 in.
Maximum travel	Walschaert, 8 in. Baker, 9 in.
Weights in working order:	
On drivers	274,100 lb.
On front truck	78,590 lb.
On trailing truck	101,400 lb.
Total engine	454,090 lb.
Tender	296,510 lb.
Total engine and tender	750,600 lb.
Wheel bases:	
Driving	18 ft. 3 in.
Total engine	45 ft. 0 in.
Total engine and tender	86 ft. 10 in.
Wheels, diameter outside tires:	
Driving	70 in.
Front truck	33 in.
Trailing truck	42½ in.
Journals, diameter and length:	
Driving, main	13 in. by 14 in.
Driving, others	11½ in. by 14 in.
Front truck	6 in. by 11 in.
Trailing truck, front	9 in. by 14¼ in.
Trailing truck, back	9 in by 14 in.
Boiler:	
Type	Ext. wagon top
Steam pressure	250 lb.
Fuel, kind	Bituminous coal
Diameter, first ring, inside	86½ in.
Firebox, length and width	144 ft. by 96¼ in.
Tubes, number and diameter	49—2¼ in.
Flues, number and diameter	214—3½ in.
Length over tube sheets	21 ft. 0 in.
Grate area	96.2 sq. ft.
Heating surfaces:	
Firebox and combustion chamber	369 sq. ft.
Arch tubes	30 sq. ft.
Thermic syphons	96 sq. ft.
Tubes and flues	4,689 sq. ft.
Total evaporative	5,184 sq. ft.
Superheating	2,360 sq. ft.
Combined evaporative and superheat	7,544 sq. ft.
Tender:	
Water capacity	15,000 gal.
Fuel capacity	18 tons
Wheels, diameter outside tires	36 in.
Journals, diameters and length	6 in. by 11 in.
Maximum rated tractive force	70,817 lb.
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent	60.36
Weight on drivers ÷ tractive force	3.87
Total weight engine ÷ comb. heating surface	60.25
Boiler proportions:	
Tractive force ÷ comb. heating surface	9.4
Tractive force × diam. drivers ÷ comb. heat. surface	658
Firebox heating surface per cent of evap. heat. surface	9.55
Superheat. surface per cent of evap. heat. surface	45.52
Firebox heat. surface ÷ grate area	5.14

The 4-8-4 type locomotives operate at a boiler pressure of 250 lb. They have 70-in. diameter drives, 27-in. by 32-in. cylinders, and develop a tractive force of 70,817 lb. They have been designated by the Wabash as Class 0-1. The principal differences in design and special equipment between the new power and the 4-8-2 type replaced. is in the design of the boiler and firebox related to substitution of the four-wheel for the two-wheel trailing truck.

Special Equipment on the New Power

The new power is equipped with American multiple throttles, piston rods and valve stems of nickel steel, Bird-Archer close-clearance blowoff cocks, Ashton safety valves, Detroit force-feed lubricators, T-Z tank-hose strainers (right side), and Nathan injectors (right side). Five of the locomotives are equipped with Baker valve gears. None of this equipment was applied to the replaced 4-8-2 type locomotives, which were described in the April, 1930, issue of the *Railway Mechanical Engineer.*

The force-feed lubricator on the right side of the Class 0-1 locomotives supplies valve oil to the valves and to the cylinders. On the left side, the force-feed lubricator supplies car oil, two feeds to each set of guides and a feeder to the flange oilers on both sides.

The operation of the force-feed lubricators from an

offset arm at the top of the combination lever of the valve gear is of interest. The lubricator on the left side is a 24-pint capacity, Model A, with six feeds. It has four low-pressure terminal checks and two flange-oiler check valves and feed nozzles. The lubricator drive arm on all 25 locomotives is 14 in. long and the lubricator connecting rod is 13 in. long. The installation was designed with the stroke at 50 per cent cut-off, and the combination lever at 90 deg. with the horizontal. The Walschaert gear has a travel of 8 in. and the Baker gear, which is installed on five locomotives, has a travel of 9 in. On 20 locomotives, with the combination lever in mid-position, 32 in. stroke, the distance from the vertical center line of the combination lever to the vertical center line of the cylinders is 49 in. With this travel and stroke, the offset arm of the combination lever is designed for a constant travel of 3⅝ in.

With the Baker-gear installation, the distance between the vertical center line of the cylinders and the combination lever in mid-position is 50½ in. The offset arm of the combination lever is designed for a constant travel of the lubricator-drive arm of 3¾ in.

The lubricator on the right side is also a Model A of 24-pint capacity. It has four feeds, four terminal checks and, like the lubricator on the opposite side, has thermostat heat control of the temperature of the oil. Its installation and operation is similar to that of the force-feed lubricator on the left side, except that the length of the lubricator-drive arm is 11 in.

The throttle for the drifting valves is located under the smoke box in front of the cylinder saddle. The piping for the installation is of double strength and is braced to prevent vibration. The installation of the piping is such as to drain off all condensation. The exhaust steam is taken for the cylinder castings immediately in front of the exhaust stand.

The Tender

The tender is of rectangular construction with a capacity for 18 tons of coal and 15,000 gal. of water. It is carried on two six-wheel cast steel trucks having 36-in. wheels with 6-in. by 11-in. journals. The water-hose connections between the tank and locomotive are provided with T-Z tender-hose couplers and strainers. The tank is constructed of copper-bearing steel.

List of Special Parts, Appliances and Equipment Applied on the Wabash 4-8-4 Type Freight Locomotives

Railroad	Wabash
Builder	Baldwin Locomotive Works
Service	Freight
Type	4-8-4
Number built	25
Firebox and Boiler	
Blower fitting	Barco
Blower valve	Okadee
Blowoff cocks	Bird-Archer
Boiler and firebox steel	Lukens
Boiler checks	Nathan
Boiler jacket	Copper bearing steel
Drifting throttle valves	Ohio Injector Co.
Feedwater heater and pump	Worthington
Firebrick arch	Economy
Fire door	Franklin
Fire door flange	O'Connor
Flexible staybolts	Flannery
Gage cocks	Sargent
Gage glasses	Nathan
Gage glass guards	Nathan
Grates	Hulson-Tuyere type
Injectors	Nathan
Injector starting valve	Sellers
Lagging	Johns-Manville
Piping	Byers-Wrought iron
Pipe wrapping	Union A. & R. Co.
Rivets	Champion
Safety valves	Ashton
Smoke box hinges	Okadee
Smoke suppressor nozzles	T-Z Railway Equip.
Smoke suppressor valve	Okadee
Spark arrester and netting	Draftac
Staybolt iron	Lewis special
Steam gage	Ashton
Steam pipe casing	Alsco
Steam valves	Hancock
Stoker	Standard-Type BK
Stoker steam gage	Ashton
Superheater	Type E
Thermic syphons	Locomotive Firebox Co.
Throttle	American Multiple
Throttle compensating lever	Jones
Throttle-rod stuffing box	Gustin-Bacon
Tubes	Pittsburgh Steel Products Co.
Flues	National Tube Co.
Washout plugs	Huron
Water column	Nathan
Whistle	Hancock
Cylinders and Running Gear:	
Back engine truck	General Steel Castings Co.
Bed frame	General Steel Castings Co.
Brake shoes	American Brake Shoe & Foundry Co.
Brasses	National Bearing Metals
Connecting rods	Carbon-Vanadium Steel
Cradle	Commonwealth
Crank pins	Carbon-Vanadium Steel
Crossheads	Laird
Crosshead guides	Laird
Crosshead Shoes	Laird
Cylinders	Cast steel
Cylinder and valve bushings	Hunt-Spiller
Cylinder and valve packing	Hunt-Spiller
Cylinder cocks	Okadee
Cylinder safety valve	Okadee
Driving box cellars	Sivyer Steel Castings Co.
Driving box lubricators	Franklin
Driving box spreaders	Alco
Driving axles	Carbon-Vanadium Steel
Driving tires	Railway Steel Spring Co.
Flange oiler	Detroit
Front engine truck	Alco
Front engine—truck centering device	Union Steel Castings Co.
Front truck axles	Carnegie
Lateral-motion device	Alco
Lubricator, hydrostatic	Nathan
Lubricator, mechanical	Detroit
Metallic packing	U. S. Metallic Packing Co.
Pedestal wedges	Franklin
Oil cups	Alemite
Power reverse gear	Alco
Rods; main and side	Carbon-Vanadium Steel
Running gear lubrication	Alemite
Springs	Railway Steel Spring Co.
Valve gear	Walschaert (20), Baker (5)
Cabs and Miscellaneous:	
Air brake gages	Ashton
Air manifold	Edna
Bell ringer	Viloco
Brakes	Westinghouse No. 6 ET
Brake-Foundation	American, WN-5
Cab apron	Ryerson
Cab seats	Gustin-Bacon
Cab windows	Prime
Cab windshields	Prime
Cut-off control gage	Ashcroft
Draw bars, engine and tender	Franklin
Engine coupler	National Malleable Castings Co.
Front bumper	General Steel Castings Co.
Headlight equipment	Pyle National
Markers, classification lamps	Pyle National
Paint	Mountain Paint & Varnish Co. (20) Duco (5)
Radial buffer	Franklin
Rerailers	Buda
Sanders	Graham-White
Steam Heat	Vapor
Wiring	American Steel & Wire Co.
Tender:	
Coupler retainers	Western Ry. Equip. Co.
Draft gear	W. H. Miner
Engine and tender connections	Barco
Farlow attachments	Symington Co.
Material for tanks	Lukens, copper-bearing steel
Tank hose	Gustin-Bacon
Tank hose strainers	T.-Z.
Tank valves	Everlasting
Tender coupler	National Malleable Castings Co.
Tender coupler centering device	Union Metal Products Co.
Tender frame	General Steel Casting Co.
Tender journal boxes	Symington Co.
Tender journal-box dust guard	J. H. Sharp
Tender journal-box wedges	Railway Devices Co.
Tender trucks	General Steel Castings Co.
Tender-truck side bearings	W. H. Miner
Tender wheels	Standard Steel Works Co.

One Hundred Years Ago.—The "Best Friend," the first locomotive built in the United States for service, successfully attained a speed of 35 m.p.h. on December 14, 1830, on the South Carolina [now part of the Southern] while running light.

Locomotives Ordered in 1930 Reflect Business Depression

Total domestic orders lowest since 1921 while Canadian orders increase — Timken roller-bearing and D. & H. 500-lb. pressure locomotives feature year's construction

ONLY 440 locomotives were ordered during 1930 for service in the United States. This number is the lowest since 1921 when 239 were ordered and, as shown in Table I, is the third lowest total number of locomotives ordered for domestic service since 1918. On the other hand, Canadian orders for 95 locomotives is an increase over the number ordered in previous years. With the single exception of the 98 locomotives ordered in 1928, the total orders placed in 1930 exceeded those of previous years back to 1920. The business depression is reflected in the total of 555 locomotives ordered from builders on this continent, including those for export, which is the lowest number ordered in the past 30 years. The explanation is found in the past year's trend of railway traffic and earnings; the depressed condition of railway business has forced railway executives into vigorous programs of retrenchment. In such a state of circumstances equipment buying, along with other railway purchasing, was no doubt held to the irreducible minimum.

It should be pointed out, however, that modern locomotives are far more powerful and far more costly than those of the days when yearly orders totaled thousands.

Modern Demands Have Made Some Types Obsolete

Table II shows the types of locomotives ordered during 1930 for service in the United States and Canada,

Table I—Orders for Locomotives Since 1918

Year	Domestic	Canadian	Export	Total
1918	2,593	209	2,086	4,888
1919	214	58	898	1,170
1920	1,998	189	718	2,905
1921	239	35	546	820
1922	2,600	68	131	2,799
1923	1,944	82	116	2,142
1924	1,413	71	142	1,626
1925	1,055	10	209	1,274
1926	1,301	61	180	1,542
1927	734	58	54	846
1928	603	98	27	728
1929	1,212	77	106	1,395
1930	440	95	20	555

and built by North American builders for export. Of some interest in connection with the information given in this table is the demise of three types of locomotives which were once popular in this country; namely, the American 4-4-0 type, the Atlantic 4-4-2 type, and the Mogul 2-6-0 type. No four coupled locomotives have been ordered for railroad service during the past two years. One 4-4-0 type was ordered in 1928, 2 in 1927 and none in 1926. No Atlantic 4-4-2 types have been ordered since 1925. None of the 2-6-0 type, formerly popular in freight service, have been ordered for railroad service since 1928. Orders for Mogul locomotives have been steadily declining since 1920, when the tabulation as shown in Table II was first published in the *Railway Mechanical Engineer.* The 4-6-4, the 4-8-2 and 4-8-4 types are being largely ordered for passenger service, and the four- and five-coupled types with two-wheel engine trucks and four- or two-wheel trailing trucks, for freight service.

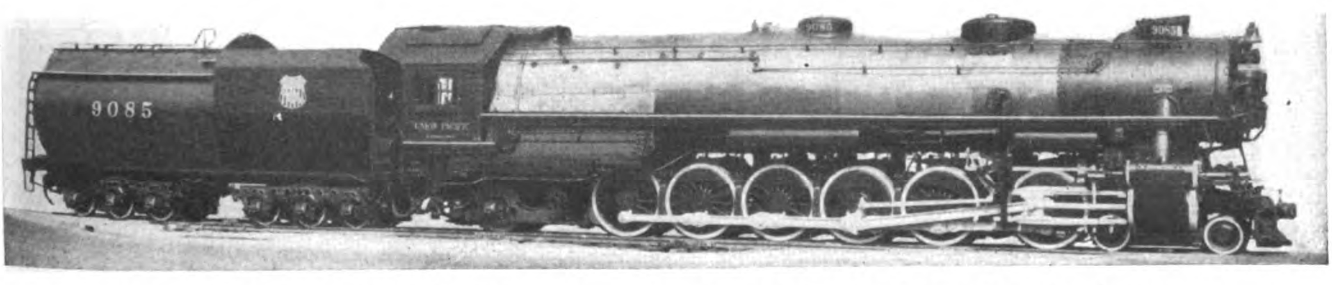
Orders in 1930 for eight-wheel switchers exceeded by 50 per cent the total number ordered of any other

Table II—Types of Locomotives Ordered in 1930

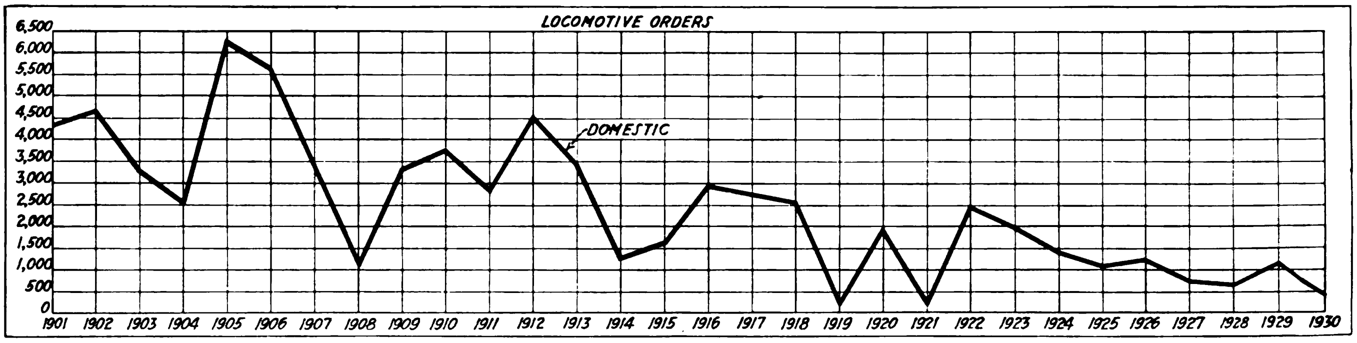
Type	Railroad	Industrial	Export	Total
0-4-0	0	32	2	34
0-4-2	0	1	0	1
0-6-0	6	10	0	16
0-6-2	0	1	0	1
0-8-0	141	1	0	142
0-10-0	1	0	0	1
2-6-2	0	1	0	1
2-8-0	23	0	1	24
2-8-2	12	3	5	20
2-8-4	10	0	0	10
2-10-0	14	0	0	14
2-10-2	12	0	1	13
2-10-4	70	0	0	70
Articulated	22	1	0	23
4-6-0	0	0	1	1
4-6-2	9	0	1	10
4-6-4	72	0	0	72
4-8-0	4	0	0	4
4-8-2	11	0	1	12
4-8-4	12	0	0	12
4-12-2	25	0	0	25
Oil-electric or gasoline	6	15	4	25
Electric	19	0	4	23
Unclassified	0	1	0	1
	469	66	20	555

type. The 141 switchers ordered composed over 30 per cent of the total orders placed by the railroads.

The Van Sweringen lines were the buyers of the largest number of locomotives during 1930, their combined purchases totaling 130. Of this total the Chesapeake & Ohio ordered 105, the Pere Marquette, 15, and



Union Pacific three-cylinder 4-12-2 type locomotive, built by the American Locomotive Company



Locomotive orders from 1901 to 1930

the Erie, 10. Other large purchases were made by the New York Central, which ordered 65 (30 for service on the New York Central, 10 for the Cleveland, Cincinnati, Chicago & St. Louis and 25 for the Boston & Albany), and the Union Pacific System, which ordered 15 for the Oregon Short Line and 10 for the Union Pacific. The Chicago Great Western ordered 21 locomotives during the year while the New York, New Haven & Hartford purchased 10 electric locomotives.

The continued trend toward the modern wheel arrangements is illustrated in Table III, which shows the orders placed since 1922 by the railroads in the United States and Canada for the principal types of steam and internal-combustion locomotives, and rail cars. Although the figures showing the orders for types placed during 1930 can hardly be used as examples to indicate trends in locomotive design, still it is of interest to note that the orders for 2-10-4, 4-6-4 and articulated types compare favorably with those of preceding years. Of the articulated types ordered, 12 were single expansion and 10 were compound.

Table III—Orders Placed by the Railroads in the United States and Canada During the Past Nine Years, for the Principal Types of Steam and Internal-Combustion Locomotives and Rail Cars

Year	2-8-0	2-8-2	2-8-4	2-10-2	2-10-4	4-6-2	4-6-4	4-8-2	4-8-4	Articulated Simple	Articulated Compound	Articulated Total	Diesel Oil-electric or Gasoline	Rail Motor-Cars
1922	73	1,231	0	157	0	299	0	158	0	0	116	116	0	49
1923	71	534	0	167	0	194	0	140	0	0	53	53	0	71
1924	61	582	0	31	0	167	0	113	0	4	30	34	0	112
1925	17	247	25	115	10	93	0	235	0	21	1	22	14	136
1926	31	220	70	25	0	193	15	326	22	0	17	17	15	135
1927	9	71	82	17	47	49	59	30	61	22	0	22	13	164
1928	6	55	42	15	46	7	35	151	63	28	0	28	4	163
1929	7	79	50	22	52	13	115	249	172	58	10	68	61	132
1930	23	12	10	12	70	9	72	11	12	12	10	22	6	53

Three railroads, as shown in Table IV, ordered locomotives of the 2-10-4 type. The ten of the 2-8-4 type were ordered by the New York Central for service on the Boston & Albany. The 72 of the 4-6-4 type and 12 of the 4-8-4 type listed in Table III were distributed among eight roads, as shown in Table V. Forty-five of the 4-6-4 type, or 62.5 per cent of the total of that type ordered, were purchased by the New York Central. The orders for the twelve 4-8-4 type locomotives were divided between two railroads, 10 being ordered by the St. Louis-South Western and two experimental locomotives for the Lehigh Valley.

Outstanding Locomotives Built During 1930

Three designs were completed and placed in operation last year which were advance steps in the efforts to secure increased capacity and improved efficiency with the steam locomotives. The first of these designs was the 4-8-4 type roller-bearing locomotive built for the Timken Roller Bearing Company. A description of this locomotive appeared in the June, 1930, issue of the *Railway Mechanical Engineer*. This locomotive, up to the middle of November, has been operated in New York Central freight service, Pennsylvania freight and passenger service, and Chesapeake & Ohio freight and passenger service. The mileage at the termination of the Chesapeake & Ohio test was 32,893 miles, of which 14,999 were operated in passenger service. It is planned to continue these demonstration tests for 100,000 miles.

The tests thus far indicate that the roller bearing provides a means of developing a locomotive which is suitable for both freight and passenger service. The Timken locomotive was not designed for heavy drag service, but it has handled trains comprising 132 cars, totalling 9,864 tons, excluding the locomotive, starting the train without difficulty. The valve events are not proportioned for this heavy drag service. Reports received from various reliable sources indicate that the Timken locomotive is performing exceptionally well in heavy passenger and fast freight service.

The second locomotive of unusual design placed in service last year was the Delaware & Hudson 2-8-0 type locomotive carrying 500 lb. boiler pressure. This locomotive named the "James Archbald," is the third of the high-pressure series of locomotives being developed by that railroad. It was described in the July, 1930, issue of the *Railway Mechanical Engineer,* page 387. No reports relative to the performance of the "James Archbald" have as yet been made available. The locomotive has been operating regularly in freight service since its delivery in April, 1930.

The 40 heavy 2-10-4 type Chesapeake & Ohio locomotives referred to earlier in this article were ordered in January of last year and delivered in September and October. These locomotives, which were described in the November, 1930, issue, page 614, are the largest and most powerful two-cylinder locomotives ever built.

The Baltimore & Ohio has recently placed in service four locomotives, the designs of which are of unusual interest. Two of the locomotives are 4-8-2 types, one of which has a radial-stay firebox and the other a water-

Kentucky & Indiana Terminal 0-6-0 type switching locomotive built by Lima Locomotive Works, Inc.

tube firebox. The other two are 2-6-6-2 types, single expansion, one having a radial-stay firebox and the other a water-tube firebox. All four locomotives operate at 250 lb. pressure. The articulated locomotives have 70-in. drivers. Descriptions of these locomotives will appear in an early issue of the *Railway Mechanical Engineer.*

Table IV—Orders for Locomotives Having Two-Wheel Engine Trucks and Four-Wheel Trailing Trucks

Road	Type	No. ordered	Weight, lb.	Tractive force, lb.
Bess. & Lake Erie	2-10-4	7	503,290	109,935
	2-10-4	2	506,970	109,935
Boston & Albany	2-8-4	10	396,100	81,400
Chesapeake & Ohio	2-10-4	40	566,000	106,584
Chi. Great Western	2-10-4	21	460,200	97,900

Six Oil-Electric Locomotives Ordered in 1930

Only six locomotives with internal-combustion power were ordered by the railroads last year. Three of these were designed to utilize three sources of power; namely, oil engine, overhead trolley or third rail, and storage battery. Two of these locomotives were ordered by the New York Central and the other by the Chicago, Rock Island & Pacific. They are rated at 1,665 hp. and weigh 257,000 lb. and 254,300 lb. respectively. The Chicago & North Western, Chicago, Burlington & Quincy and the Canadian National each ordered one internal-combustion unit. All six of these locomotives were ordered for switching service.

Table V—Orders for Locomotives Having Four-Wheel Engine Trucks and Four-Wheel Trailing Trucks

Road	Type	No. ordered	Weight, lb.	Tractive force, lb.
Boston & Albany	4-6-4	5	356,500	55,320
	4-6-4	10	355,200	55,400
Canadian National	4-6-4	5	356,400	43,300
Canadian Pacific	4-6-4	10	350,900	45,200
C. C. C. & St. L.	4-6-4	10	....	.....
Lehigh Valley	4-8-4	1	425,000	66,400
	4-8-4	1	426,000	66,700
Maine Central	4-6-4	2	312,590	41,300
New York Central	4-6-4	30	....	.....
St. L. South West	4-8-4	10	425,000	61,500

Last year's orders for this type of locomotive, as shown in Table III, came very close to the low record of four in 1928. Orders for 61 in 1929 constitute the best record thus far established. However, the orders placed last year by the railroads amount to only 24 per cent of the total number of internal-combustion locomotives ordered. Fifteen oil- or gas-electric locomotives were ordered by the industrial concerns, and four were ordered for export, a total of 25 locomotives.

Orders for Rail-Motor Cars

The railroads in the United States and Canada ordered 53 rail-motor cars and 9 trailers during 1930. As with other types of equipment, this marks a decided recession in the number of motor cars ordered in previous years. The number of rail-motor cars and trailers ordered during the past four years is shown in a table listing the types of passenger equipment ordered, which is included in an article elsewhere in this issue, reviewing the freight- and passenger-car orders in 1930.

Table VI—Power Plant Capacity of Rail Motor Cars, U. S. and Canada

Horsepower	1925	1926	1927	1928	1929	1930
100 or less	13	14	2	5	6	2
Over 100 to and including 125	5	7	..	1	3	..
Over 125 to and including 150	9	..	..	4	1	..
Over 150 to and including 175	20	1	..	1	..	..
Over 175 to and including 200	49	3	3	1	..	..
Over 200 to and including 250	36	65	43	13	2	..
Over 250 to and including 300	2	26	76	64	15	7
Over 300 to and including 350	..	..	..	30	2	2
Over 350 to and including 400	2	..	..	18	64	25
Over 400 to and including 450	..	8	7	6	2	..
Over 450 to and including 500	.	11	1	4	5	..
Over 500	..	.	8	15	30	17
Unclassified		..	24	1	2	..

Although the number of cars ordered is relatively small, an analysis of the orders according to power-

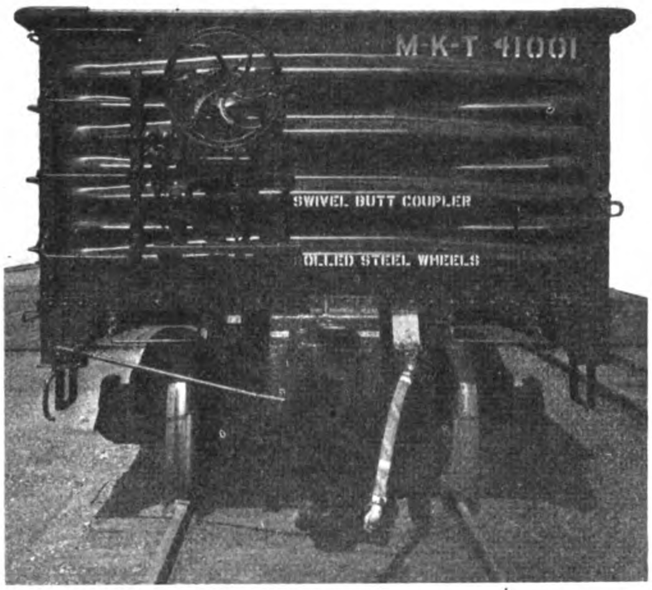
(*Concluded on page 76*)

Minneapolis & St. Louis 72-ft. mail and baggage car powered with a Model 148 400-hp. Electro-Motive oil engine—Car built by the St. Louis Car Company

Katy Builds 70-Ton Gondolas

THE Missouri-Kansas-Texas Lines is building at the Denison (Texas) car shops 500 all-steel, solid-bottom gondola cars. The cars are primarily designed for the hauling of chat, sand and gravel, of which a considerable quantity is handled by the railroad and for which suitable heavy equipment has not been available.

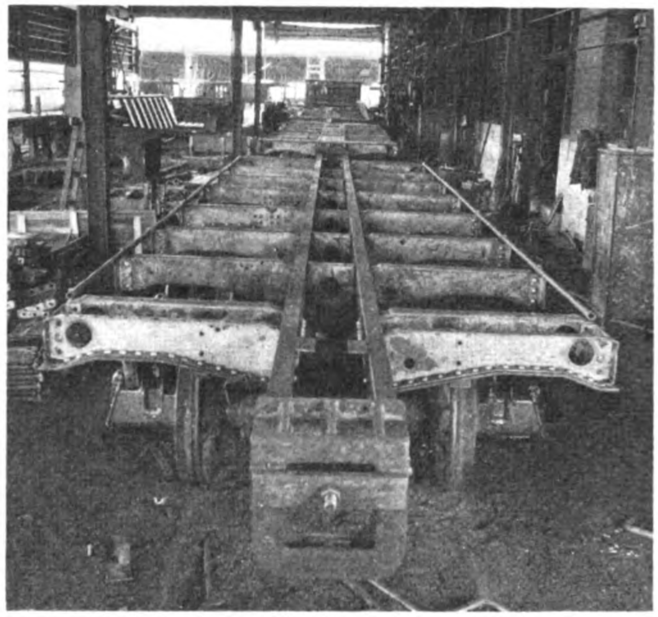
The cars are made entirely of steel, except the floor, for which 2¾-in. black gum creosoted decking is used. Copper-bearing steel is used throughout the car in all steel plates and pressings. The body of the car has an inside length of 41 ft. 3 in., inside width of 9 ft. 3 in., and an inside height of 4 ft. 8 in. The center sills are made up of two 40.3-lb. A.R.A. center-sill sections with a ⅜-in. by 24-in. cover plate of copper-bearing steel. The side sills consist of 10-in., 30-lb. structural channels. Crossbearers and cross-ties consist of 5/16-in. copper-bearing steel pressed diaphragms. The sides are ¼-in. thick copper-bearing steel and are braced by eight 5/16-in. pressed copper-bearing steel flanged U-shape posts. The side and end plates consist of 5-in. by 3½-in. by ⅜-in. bulb angles.



End-view of car showing modern equipment, including bottom-operated swivel butt coupler

In building the car, every precaution was taken to assure long life of the steel members by the use of rust preventative material. The whole underframe was painted with car cement and the top surface of the underframe covered with three-ply roofing paper laid in car cement of trowel consistency. All metal joints were laid in red lead and all crevices were thoroughly filled with the same mixture after the parts were assembled.

The cars have a capacity of 140,000 lb., a load limit of 161,100 lb., and a light weight of 48,900 lb. The cubical capacity, level full, is 1,780 cu. ft., and 2,250 cu. ft. when heaped.



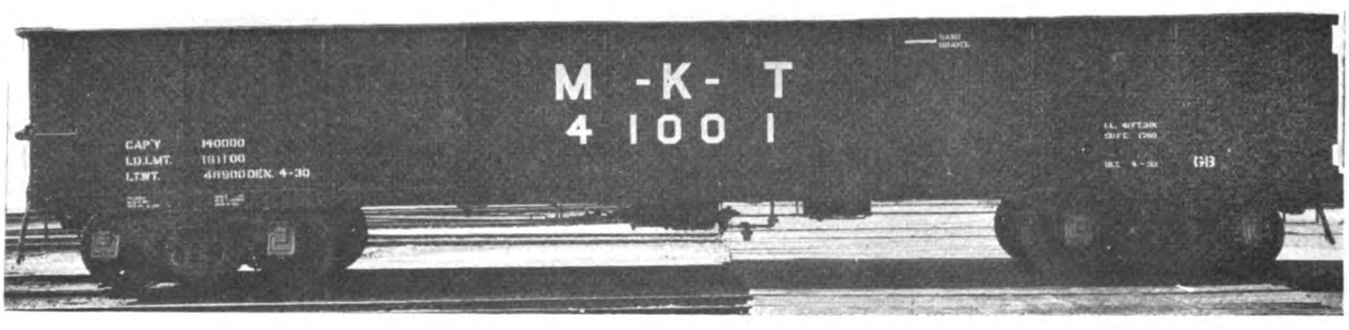
Assembly operations underway at modern-equipped steel car shop of the Katy at Denison, Tex.

The trucks have cast-steel side frames with journal boxes cast integral and are of the Dalman design with one-level springs. E. S. Woods forged-steel truck roller side bearings are applied. The truck frames have Mobil, Type A, brake-hanger brackets. The wheels are 33-in. rolled steel Multiple-wear wheels.

Waugh No. 403 draft gear is used in connection with Farlow attachment and Symington swivel-butt couplers; the couplers are of the bottom rotary-operated type. The cars are also equipped with Dreadnaught steel ends and Union centering devices for radial couplers.

Particular attention was given to the piping of the cars and, in order to eliminate threaded joints, the brake pipe is welded. It is secured by Wright pipe clamps.

Ureco hand brake is used and the brake step is of metal furnished by the Morton Manufacturing Company.



An efficiently-designed car which will earn revenue for a long period with little maintenance

Machine Tools and Shop Equipment Ordered in 1930

DURING the past year 84 railroads in the United States, Canada and Mexico, representing 88 per cent of the total route mileage of the North American Continent, reported the purchase of 2,316 units of machine tools and shop equipment. This total is 374 units less than the total number purchased during the preceding year when 88 railroads, representing 89 per cent of total route mileage of the continent, placed orders for 2,690 units.

Machine Tools and Shop Equipment Purchased Over a Seven-Year Period

	1930	1929	1928	1927	1926	1925	1924
Lathes							
Axles	25	36	28	27	72	47	35
Engine	84	134	115	149	236	178	209
Turret	24	48	38	33	55	51	93
Wheel	24	25	11	14	32	34	26
Drill Presses							
Radial	31	42	31	48	93	65	71
Vertical and others	35	121	63	92	203	114	107
Planers	13	19	12	23	39	25	40
Shapers	20	53	42	46	75	70	74
Slotters	2	11	6	8	7	9	13
Boring Mills							
Horizontal	4	7	8	4	13	13	16
Vertical and others	31	53	46	49	93	56	64
Milling Machines							
Universal	2	4	5	8	26	15	18
Horizontal and others	16	53	24	19	37	23	32
Grinding Machines							
Cylindrical	2	8	13	10	20	9	13
Internal	8	13	27	32	20	36	20
Surface	1	27	10	10	22	14	17
Double end, tool and others	182	258	224	236	346	232	190
Metal cutting saws	28	35	29	31	68	40	36
Portable boring, facing and turning machines	29	30	34	29	80	58	51
Bolt threaders and cutters	13	43	27	30	54	53	54
Pipe cutters and threaders	22	50	35	45	66	40	42
Presses							
Wheel	20	13	4	17	24	22	20
Others	30	33	50	42	74	60	58
Hammers							
Steam	7	8	18	12	37	34	19
Other power	13	15	21	18	24	10	12
Forging Machines							
Bulldozers	4	5	2	9	5	6	11
Others	3	20	3	5	20	6	12
Punches	3	10	10	4	30	15	13
Shears	18	36	42	23	72	31	41
Combination Punch and shear	8	16	16	20	39	33	22
Flue Shop Machinery							
Flue welders	5	7	9	12	16	7	22
Miscellaneous	4	20	14	24	11	19	32
Boiler Shop Machinery							
Flangers	1	6	9	4	17	21	17
Forming rolls	3	12	9	9	14	9	12
Riveters	12	37	7	5	15	8	..
Blowers	37	40	53	37	100	97	..
Furnaces							
Oil	32	52	64	53	68	63	..
Electric and others	27	118	43	27	18	96	..
Woodworking Machinery							
Boring machines	4	15	11	12	9	8	10
Mortisers	5	15	9	11	21	16	13
Surfacers and jointers	23	16	18	15	43	17	17
Tenoners	4	13	7	5	11	11	12
Wood cutting saws	19	31	33	57	93	64	62
Others	25	40	32	24	39	44	32
Overhead cranes	17	81	39	32	50	23	..
Car and loco. hoists and drop tables	40	65	60	63	24	14	..
Hoists							
Air	84	66	75	53	116	101	..
Electric	82	177	44	56	54	51	..
Chain	34	30	42	85	41	78	..
Trucks							
Electric	71	64	90	55	98	114	..
Gas	66	126	65	33	76	17	..
Trailers	785	157	395	132	135	85	..
Air-brake test racks	11	10	30	43	28	24	..
Air compressors	39	66	52	64	82	54	..
Motors	115	124	101	122	138	27	..
Electric welders	69	96	72	46	158	110	..

The 2,316 units ordered in 1930 also represents a decrease of 61 units under the purchases of 1928 when 87 railroads, representing 85 per cent of the total route mileage, placed orders for 2,377 units of this type of equipment. Although the purchases of last year fell below those of the preceding two years, they represent an increase of 44 units over the orders placed in 1927 when 99 railroads, representing 88 per cent of the total route mileage reported their orders. Compared with the purchases of 1926 when 97 railroads, representing 84 per cent of the total route mileage, purchased 3,457 units of this type of equipment, the 1930 orders represent a decrease of 1,141 units.

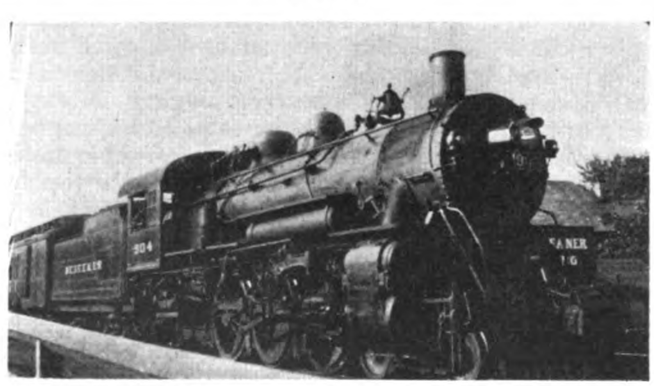
Although the general trend in the purchases of this class of equipment during 1930 was downward, the orders placed for several types of machine tools closely approximated the number purchased during the preceding year. Of these, the number of orders placed for wheel presses was the most outstanding, 24 being ordered last year as against 25 in 1929. Orders for portable boring, facing, and turning machines which were placed last year, number 29 as against 30 for the preceding year. It is noteworthy that the 1930 purchases of various types of presses exceeded those of the preceding year, 50 of these machines being bought in 1930 as against 46 in 1929. The number of power hammers purchased during 1930 closely approximated the number purchased during 1929, 20 of them being bought last year as against 23 during the preceding year.

Although, as a class, there were fewer forging machines purchased during 1930 than during the preceding year, the railroads bought 4 bulldozers last year as against 5 in 1929. The orders for flue welders in 1930 numbered 5 as against 7 in 1929, while the orders for various types of blowers last year numbered 37 as compared with 40 for the preceding year. In orders placed for woodworking machines, surfacers and jointers alone exceeded the 1929 orders, 23 such machines being purchased in 1930 as against 16 in 1929.

Material-Handling Equipment

During the past year there was an increase in the purchases of air and chain hoists, but a decrease in the purchases of electric hoists. The only group of equipment which showed a marked increase in purchases during 1930 was that of electric trucks, gas trucks and trailers, although individually the orders placed for gas trucks during 1930 were considerably less than the orders placed in 1929. The orders placed for electric trucks increased slightly, while the number of trailers ordered was practically double the number recorded for 1928.

* * *



From collection of Geo. M. Sittig

Bessemer & Lake Erie 4-6-2 type locomotive built at Schenectady, N. Y., in 1913

Roller Bearings for Locomotives and Cars

A summary of selected questions and answers bearing upon the design, operation and future possibilities of this type of equipment in the railway field

AT a meeting of the Central Railway Club of Buffalo on November 13, 1930, T. V. Buckwalter, vice president of the Timken Roller Bearing Company, presented a paper entitled, "Roller Bearings for Locomotives and Freight cars." Essentially the same paper was presented a month later at a regular meeting of the Railway Club of Pittsburgh. That the presentation of this paper before these two organizations was received with a great deal of interest is evidenced by the fact that a number of questions bearing upon the design, operation and future possibilities of this type of equipment were asked. An abstract of the paper was published in the Railway Age for November 29, 1930 on page 1177. A complete description of the Timken demonstration locomotive was published in the June, 1930 *Railway Mechanical Engineer* on page 316. Many of the questions that were brought up in the discussion at the two railway clubs mentioned are of such general interest that a selected group of these questions have been taken for publication in this article. (*The questions in each case were asked by members on the floor and, for the information of the reader, all of the answers were given by Mr. Buckwalter.*—EDITOR.)

Discussion at the Central Railway Club of Buffalo

Question: Is the application of roller bearings to locomotive rods contemplated?

Answer: It is recognized that the rod is an application requiring considerable study. In fact, it is a study by itself. There was a certain amount of uncertainty in building a roller bearing. It was decided to attach the wheels first and apply the bearings to the roads at the expiration of 100,000 miles. There is a small locomotive which has been operating since last April equipped with roller bearing rods and the service to date has been satisfactory.

Question: In connection with the application of roller bearings to main and side rods, particularly at the back end of the main rod, what means are you going to employ to lubricate the bearing?

Answer: The application of roller bearings is a difficult problem inasmuch as a stationary housing is not available which may be readily extended to provide a reservoir for lubricant. The oil available for side rod application is considerably reduced as compared with an axle application. The experience available on a small locomotive and on stationary engines indicates that lubricant is retained in a more satisfactory manner than would be apparent on the surface. The probabilities are that a special lubricant will be advisable for side rod roller bearing applications.

Question: Have you had any hot bearings on the Timken roller bearing locomotive so far?

Answer: There has been no trouble with the roller bearings. However, some troubles were experienced with hot rod bearings on the original runs. The original installation comprised the conventional press-fitted rod bushings. The original installation was apparently slightly out of tram and the wide disparity between roller bearings on the axle and the plain bearings on the rods led to the severe punishment of the latter. This is apparently due to the facts that the roller bearing surrounds the axle 100 per cent and has tremendously greater capacity than the side-rod bearings. A slight inaccuracy in tramming led to the punishment of the latter. The trouble with the side rod bearings was eliminated entirely by re-tramming and by the use of floating bronze bushings.

Question: How many miles is this roller bearing locomotive expected to run before requiring repairs or renewal to the roller bearings?

Answer: That is a difficult question to answer. Our expectation is that the bearings will have a life in excess of 250,000 miles. This is based on our experience with heavy loads sustained 24 hours a day after a period of years in steel mill service. It will be recalled that roller bearings in steel mills are still operating after rolling 400,000 tons of steel, 17 passes to the ton, or a total of 7,000,000 tons of steel having passed over the bearings. Our expectations are that some bearings may fail in 250,000 miles; that some bearings will operate for 1,000,000 miles. It would not be surprising if an average life of 500,000 miles would be obtained.

Question: What is the special method of crowning used in connection with the floating split bearings?

Answer: We line the rods with a steel liner made out of exceptionally hard steel and that liner is reverse crowned, the radius of the crown being equal to the spacing between the drivers—roughly, 77 in. The floating bronze bushing is crowned to correspond with these liners in the rods. The bore of the bronze bushing is parallel and fits the pin. The theory is that the floating bushing alines itself with the reciprocating motions of the rods and allows the pin to get a full contact with the floating bushing.

Question: How are the shoes and wedges fitted?

Answer: Pounding occurs only in the presence of lost motion. A pound cannot develop on closely fitted surfaces. It is not possible to strike a blow without first lifting the hammer. The roller bearing has a very slight movement and the piston thrusts are sustained by a complete steel train of parts. The lost motion in the bearing itself is negligible, the looseness within the bearing being so slight as to be completely absorbed by the oil film. The bearing housing and the trunnion guides are mounted so as to move freely in the pedestals but inasmuch as these surfaces are all hardened steel and lubricated, the tendency to pound is corrected. It is apparent that the absence of pound is explained by the fact that the axle is completely surrounded by the bearing.

Question: How are the housings built on the drivers?

Answer: The lubrication of the locomotive has been

worked out in a thorough manner. No necessity has arisen for renewing lubrication after 35,000 miles of operation. Samples have been taken from the lubricant, however, for analysis, as this analysis provides a certain and simple test for the presence of alloys as used in bearing manufacture. It is not considered advisable to operate for periods longer than from three to six months because of deterioration of the lubricant and the increase of the moisture content of the lubricant.

Question: What kind of oil do you use in the roller bearings?

Answer: We are using the regular valve oil on these bearings. There has been quite a difference of opinion to the type of lubricant necessary for roller bearings. The chief characteristic necessary in a lubricant for a roller bearing is that it protects the bearing from foreign matter, moisture and grit. It does very little in reducing friction because the roller bearing itself reduces the friction. We use valve oil on the locomotive because it is available at all enginehouses. We use car oil in passenger car bearings and generally use car oil in the freight car bearings. If some railroads desire to use some other oil that is special with them we, as a rule, have no objection although we are careful to analyze it and see that it is suitable before approving it. As a rule, any satisfactory railroad oil operates very nicely on roller bearings.

Is the application of roller bearings to main and side rods contemplated? If so, what means of lubrication are going to be employed to oil them? Is it possible to apply roller bearings to the crossheads and guides? In what distance could a freight train equipped with roller bearings be stopped? What is the approximate increase in cost of a roller-bearing equipped locomotive over the same type of locomotive without roller bearings?
In the accompanying article, answers to these and other questions are made by T. V. Buckwalter, vice president of the Timken Roller Bearing Company.

Question: Is it possible to apply roller bearings to the crossheads and guides on a locomotive?

Answer: A crosshead application of roller bearings will require some means to enclose the rollers and working surfaces. Otherwise, the surfaces and the rollers would be subject to wear because of exposure to dust and grit in the atmosphere. The crosshead application that has been made on the Timken locomotive promises an immediate relief involving, as it does, a hardened steel guide in connection with tin-lined crosshead shoes. The grit that is embedded on the tin is not sufficiently hard to cut the hardened steel guides. Consequently, the rate of wear, friction and the heating is greatly reduced. The experience of machine tool builders at the close of the war is of particular interest in connection with the study of present-day operating costs. The machine tool builders emerged from the war without any business and with greatly expanded plant facilities which had been made during the war. They utilized this opportunity to develop an entirely new line of tools adaptable to every class of work. These machines were capable of making such improvements in quality and reduction in operating costs that the machine tool users found it advantageous to scrap their existing plant equipment and purchase an entirely new complement of equipment. This not only reinstated the machine tool industry but effected important economies in the production of nearly all articles of manufacture. An example is the reduction in cost and selling price of automotive equipment. There are numerous manufacturing interests that re-equipped their plants throughout with the machine tools available during the last decade and have not only effected immediate reductions in manufacturing costs but have obtained these advantages with an improvement in quality. Manufacturers that have not taken advantage of these improvements in machine tools have, as a general rule, passed out of the picture. It is apparent, therefore, that the best defense against conditions experienced at the present time is to discover some means of reducing the cost of operation. The roller bearing is offered as one method of effecting this reduction. The general adoption of the plan of rehabilitation on the part of the railroads would undoubtedly lift the country from the depression in which it finds itself at the present time.

Question: Mention was made about freight trains equipped with roller bearings. What would be the difference in distance required to bring such a train to a stop as compared with one equipped with plain bearings?

Answer: The roller friction is about one-fourth of one per cent, probably a little less than that. The braking friction is about 25 per cent. If we assume these figures to be correct, the braking friction is 100 times the rolling friction. From these figures if a plain bearing car could be stopped at a certain speed in 100 ft., the roller bearing car could be stopped with the same application of brakes in 101 ft. The increased distance is between one-half and one per cent in order to make a stop at a given point.

Discussion at the Railway Club of Pittsburgh

Question: Approximately what is the increase in cost of a roller-bearing equipped locomotive over the same type of locomotive without roller bearings?

Answer: The additional cost of the roller bearing locomotive at the present time is about 10 per cent greater than the corresponding plain bearing locomotive. These figures will be subject to considerable revision as we obtain more experience in manufacturing housings and fittings to accommodate the bearings. The bearings themselves are not so much more expensive but some of the housings and fittings are, particularly the hardened steel parts required to resist the piston thrust. I think the additional cost of 10 per cent is a fair figure. At least, it is as accurate as anything we know at the present time. In taking this cost of 10 per cent, consideration should be given to the additional power the roller-bearing locomotive develops over and above that of the corresponding plain bearing locomotive. I do not know of any eight-coupled plain bearing locomotive that develops over 3,800 h.p. at 40 m.p.h. If the roller bearing locomotive of corresponding size develops 4,600 hp. that is a material advantage, particularly at high speeds at which freight must be operated in the future in this country to compete with trucks.

Question: What effect would water in the bearing housings have on operation? (This question was asked by a representative of a road which experiences flood conditions frequently.)

Answer: If a locomotive or car operates through water of sufficient depth to flood the housings, the oil and water must be drawn out and fresh oil added within a few days. There is no immediate danger because corrosion is rather slow and does not have any immediate effect, but if the water should remain in the housing for a period of months, it would certainly attack the roller bearings.

Question: The speaker has mentioned the application of roller bearings to locomotive engine trucks. No doubt he has made a study of the thrust on such bearings. Most all roads have had trouble with fire-cracks due to the terrific heat developed on account of thrust. Are there any figures available on the amount of such thrust?

Answer: The best information available is, that the thrust may amount to about 80 per cent of the weight. That figure is about twice what we figure on freight- and passenger-car thrust reactions. The bearing we will provide for this service will take about 120 per cent of the weight. We provide 120 per cent thrust capacity measured against the radial capacity of the bearing. We do not have any more exact information than this. Probably the reason why thrust plates on engine trucks and drivers give so much trouble is because they are radial plates and centrifugal force throws out the lubrication so that after a few miles they have dry surfaces operating against each other at high speed. Even if the unit pressure is not high the development of heat is high enough to develop the heat checks observed on engine trucks. On the driver bearing or the engine-truck bearing, the thrust reaction on the roller bearings is taken entirely on the roller surfaces.

Question: The statement was made that the cost of one failure of a standard journal bearing or one hot box would cover the cost of equipping a car with roller bearings. If I understood correctly, the speaker made the statement that the cost of installation of roller bearings would be about 10 per cent of the cost of the car. Does he mean 10 per cent of the cost of reproduction new, or 10 per cent of the original value of the car?

Answer: We have been trying to find out what the actual cost of a hot box amounts to. We arrived finally at a figure of $25 per hot box. We have had figures all the way from $5 to $200 per hot box. An analysis of what happens when a hot box takes place would be interesting. We have first the stoppage of the train and the traffic behind it, the crew going back to examine the train and see what happened and how serious it is; then going ahead at slow speed to a set-off track; then coupling up the train and going on. We have the shop operation and the cost of making repairs to the car and getting it into a shop where complete repairs may be made, where that involves the application of a new axle. Anything from $10 to $200 may be involved and if we assume $25 as a fair average that would pay the interest charges on the additional cost of applying roller bearings to a freight car. The problem we set up for ourselves is the application of roller bearings to a 50-ton freight car at a cost not to exceed $300. From what we know of the subject, if we can obtain this result and sell the necessary equipment at a price not to exceed $300, the use of roller bearings on freight train equipment would be justified. If one hot box per year per car were eliminated it would pay the interest and obsolescence on the equipment cost.

It would also permit higher speeds; it would reduce car-body roll because the lateral motion of a roller bearing housing is against a fixed resistance and the tendency is to counteract the free rolling of the car body, whereas the lateral resistance of a plain bearing is zero. That encourages the development of car-body roll and leads to more severe blows on the rail. The experience we have had, involving over 100 cars, indicates that the roller bearing will reduce considerably the severity of car-body roll.

Another point is that freight must be moved at high speed. The automotive industry is engaged in the development of power application to five-ton truck equipment on pneumatic tires that will develop 150 to 175 hp. and move freight along the highways at passenger automobile speed, around 50 to 55 miles an hour. That is going to cost more money than railroad freight movement but it reduces tremendously the cost of doing business in an industrial establishment. It reduces the inventory item in a factory as much as two or three million dollars. I am convinced that the day of high speed freight is coming; that the economy effected in manufacturing the products of commerce will justify the cost of high-speed freight. The railroads must meet this competition of the motor truck. Experience with the roller-bearing locomotive in handling some 80,000,000 ton-miles developed this: That the average speed between terminals is 86 per cent higher than the average railroad speed of 12½ to 13 m.p.h. That average speed developed a certain number of miles per hot box. The average behind the Timken locomotive at the higher speed is 92 per cent more hot boxes in the train. This indicates that higher speeds must be paid for in more frequent hot boxes. The answer is a better plain bearing or a roller bearing. We think that a cost of $300 per car is entirely justified—this does not take into consideration the cost of the truck side frame because that would have to be changed anyway to comply with the new regulations of the A. R. A.

Locomotives Ordered In 1930

(*Continued from page 71*)

plant capacity and car weights, shown in Tables VI and VII, indicates no recession in the trend toward more power and greater weight. In 1928, 27 per cent of the motor cars ordered for service in the United States and Canada had power plants exceeding 350 hp. in capacity. In 1929 over 76 per cent of the cars had

Table VII—Comparison of Rail Motor Weights, U. S. and Canada

Weights	1925	1926	1927	1928	1929	1930
25,000 and under	6	7	..	3	3	..
Over 25,000 lb. to and including 50,000 lb.	19	7	..	4	6	..
Over 50,000 lb. to and including 75,000 lb.	74	2	4	4	..	2
Over 75,000 lb. to and including 100,000 lb.	27	79	29	16	5	..
Over 100,000 lb. to and including 125,000 lb.	7	32	88	62	20	2
Over 125,000 lb. to and including 150,000 lb.	..	5	21	58	54	29
Over 150,000 lb. to and including 175,000 lb.	..	..	..	11	24	13
Over 175,000 lb.	..	1	..	..	7	..
Unclassified	..	..	26	5	13	7

power plants rated at over 350 hp. Last year 42 of the 56 cars ordered, or 75 per cent of the total, were rated at over 350 hp., and 17 of the 42 were rated at over 500 hp. The weights of 29 of the cars fell between 125,000 and 150,000 lb. and of 13 of the cars between 150,000 and 175,000 lb. All of the cars ordered for public service railways in the United States and Canada are equipped with either gas-electric or oil-electric power plants. In the United States an order for one oil-electric car was placed by the Great Northern and in Canada orders for six were placed by the Canadian National.

Small Number of Cars Ordered in 1930

Total orders for freight and passenger cars the lowest since 1921 — Orders for gondola and box cars continue to dominate types of freight equipment ordered—28 per cent of passenger cars ordered are "through-train" equipment

THE total orders for freight and passenger cars placed during 1930 with builders in the United States and Canada were the lowest since 1921. Only 46,360 freight cars were ordered last year for service in this country and only 1,936 for service in Canada. This figure of Canadian orders, as shown in Table I, is one of the six lowest Canadian totals of the past 13 years. The domestic total for 1930 is less than half that of 1929 and is one of the three lowest in the past 30 years.

Only 667 passenger cars were ordered last year for service in the United States and 203 for service in Canada, a total of 870 for both countries. As shown in Table II, the 1930 domestic orders for passenger equipment, exclusive of rail-motor cars and trailers, were slightly over one-fourth of the 1929 total, about 29 per cent. On the other hand, the Canadian total of 203 compares favorably with previous years.

Table I—Orders for Freight Cars Since 1918

Year	Domestic	Canadian	Export	Total
1918	114,113	9,657	53,547	177,317
1919	22,062	3,837	3,994	29,893
1920	84,207	12,406	9,056	105,669
1921	23,346	30	4,982	28,358
1922	180,154	746	1,072	181,972
1923	94,471	8,685	396	103,552
1924	143,728	1,867	4,017	149,612
1925	92,816	642	2,138	95,596
1926	67,029	1,495	1,971	70,495
1927	72,006	2,133	646	74,785
1928	51,200	8,901	2,530	62,631
1929	111,218	9,899	3,023	124,140
1930	46,360	1,936	1,200	49,496

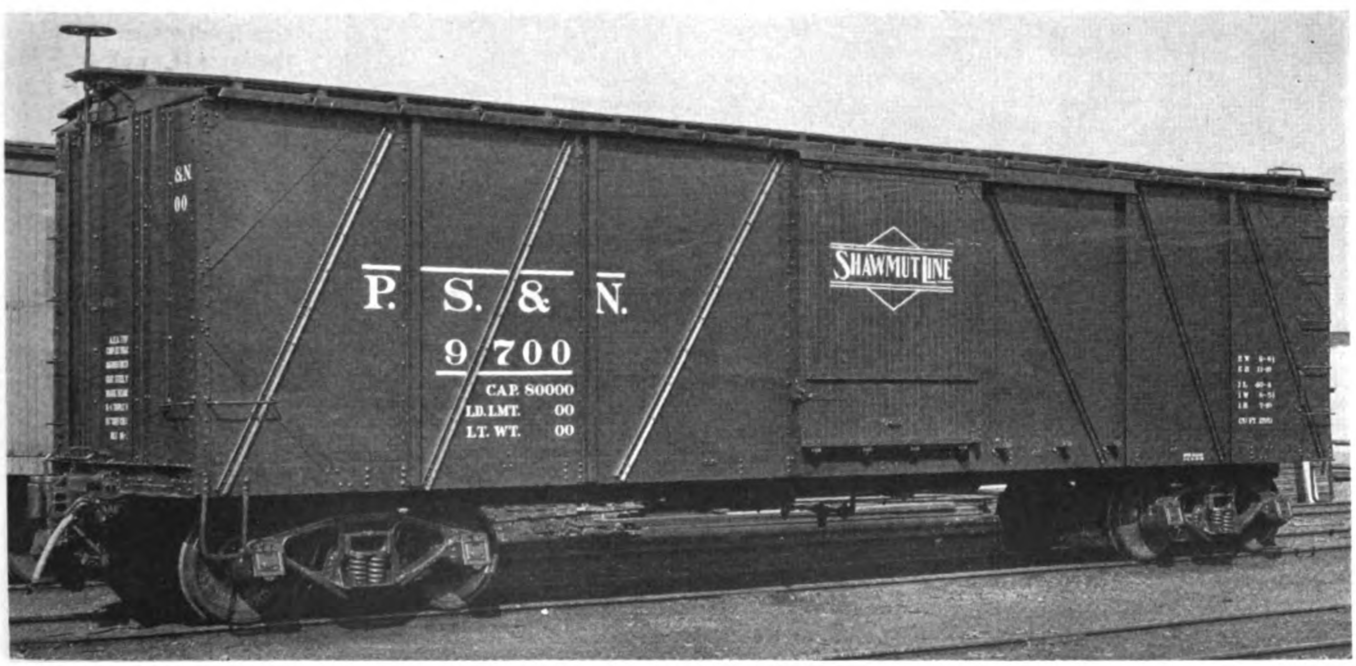
As a whole, the number of passenger cars ordered reflects not only the current general business depression, but the continued loss of passenger business to unregulated competing forms of transportation. These two factors combined forced a drastic curtailment in the buying of this class of equipment, with the result that 1930 ranks fourth as the poorest year in this respect since 1901.

Freight Car Orders in 1930

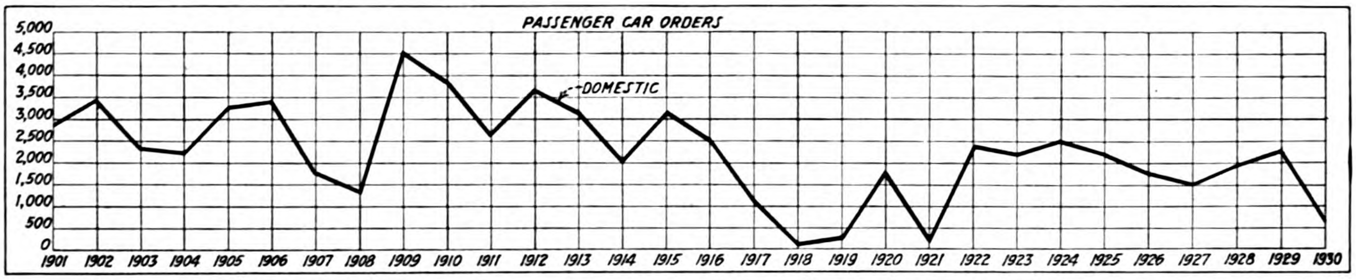
Table III shows the number of freight cars ordered in 1930 for use in the United States and Canada classified according to type. Of a total of 48,296 freight cars ordered, 10,828 or 22.4 per cent were gondola cars and 13,248 or 27.4 per cent were box cars. A total of 121,117 freight cars were ordered in 1929. Of this total figure, 18,810 or 15.5 per cent were gondola cars and 47,617 or 39.3 per cent were box cars.

The business depression and its effect on railway traffic and earnings, and increased highway and waterway competition is undoubtedly the primary cause for the abnormally low number of freight cars ordered last year. The traffic decline, commencing in October, 1929, has continued unarrested throughout 1930 until carloadings have reached their lowest totals since 1922. Likewise railway earnings have declined sharply and thus a drastic curtailment of equipment purchases was not an unexpected development.

In the forefront among 1930 freight car buyers were



Pittsburgh, Shawmut & Northern 40-ton single-sheathed box car built by the Mather Stock Car Company



Passenger car orders from 1901 to 1930

the Van Sweringen lines. These roads purchased 13,-754 cars or more than one-quarter of the year's total. Of the 13,754, the Chesapeake & Ohio ordered 6,504, the Pere Marquette, 4,875 and the Erie, 2,375. Other large purchasers were: Chicago, Milwaukee, St. Paul & Pacific, 2,812; Baltimore & Ohio, 2,002 and Seaboard Air Line, 2,000. Of the Canadian cars ordered, the Canadian National purchased 781 and the Canadian Pacific 1,155.

Of interest in connection with the designs of freight cars ordered last year are the large number built to A. R. A. standard dimensions and designs. An analysis of the freight cars ordered during the past three

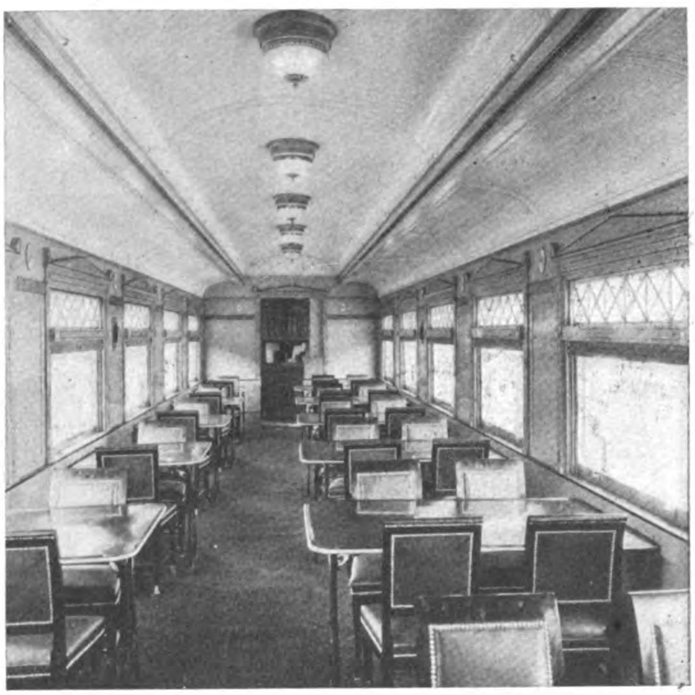
Table II—Orders for Passenger Cars Since 1918

Year	Domestic	Canadian	Export	Total
1918	9	22	26	57
1919	292	347	143	782
1920	1,781	275	38	2,094
1921	246	91	155	492
1922	2,382	87	19	2,488
1923	2,214	263	6	2,483
1924	2,554	100	25	2,679
1925	2,191	50	76	2,317
1926	1,868	236	58	2,162
1927	1,612	143	48	1,803
1928	1,930	334	29	2,293
1929	2,303	122	33	2,458
1930	667	203	15	885

years shows that the work done by the A.R.A. Mechanical Division is beginning to bear fruit. This is especially noticeable with respect to single- and double-sheathed box cars, for which standard designs were first adopted.

Of further interest is the increase in the number of 65-ft. mill-type gondola cars for which there appears to be an increasing demand. Of the freight cars ordered last year, 1,775 cars or 3.5 per cent, were of this type. The Pennsylvania ordered 1,700 gondola cars having a length of 65 ft. 6 in., which were built in its own shops.

Table IV shows the freight-car production totals for each year since 1913. These figures should not be compared with the totals of orders placed. The production figures show the number of cars actually built during the year and, of course, includes cars ordered the preceding year.



Atchison, Topeka & Santa Fe dining car equipped for conditioning the air. Built by Pullman

Passenger-Car Orders in 1930

Table V shows the types of passenger equipment ordered during the past four years. Included in this table are the orders for rail-motor cars and rail-motor car trailers, two types which were not considered when making the compilations for this table previous to this year. An analysis of the characteristics of the rail-

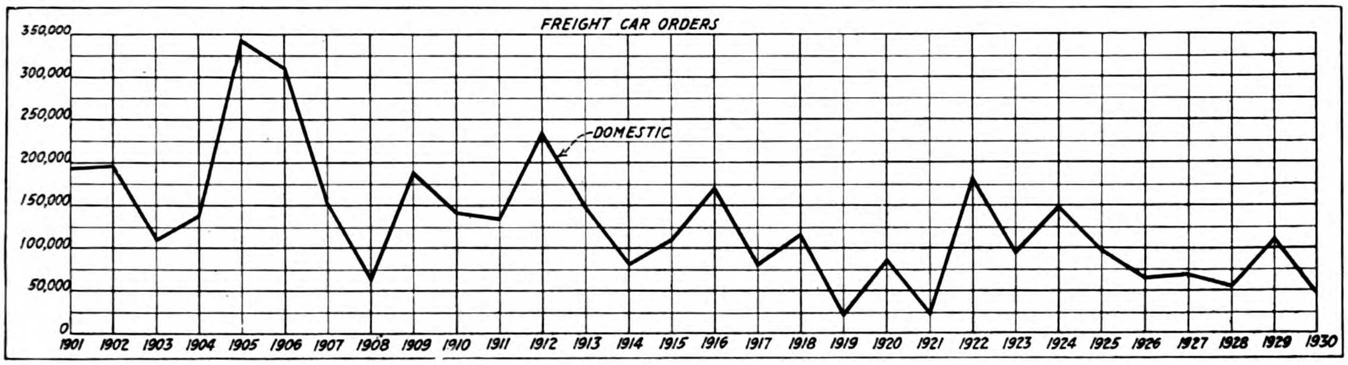
Table III—Types of Freight Cars Ordered in 1930 for Use in the United States and Canada

Type	Number	Per cent
F—Flat and logging	2,159	4.5
G—Gondola	10,828	22.4
H—Hopper	5,248	10.8
R—Refrigerator	6,890	14.4
S—Stock and Poultry	980	2.0
T—Tank	3,623	7.6
X—Box	13,248	27.4
Automobile	4,364	9.0
Ballast, dump and ore	448	.9
Not classified	297	.6
N—Caboose	211	.4
Total	48,296	100.0

motor equipment ordered in 1930 is included in the article reviewing last year's orders for locomotives, elsewhere in this issue.

Twenty-eight per cent of the passenger cars ordered in 1930 were sleeping, parlor, chair and other special types designed primarily for service on through trains. A total of 227 cars ordered, or 26 per cent, were for day-coach service. An interesting comparison with preceding years are the orders for baggage, express and mail cars. For the three years previous to 1930, orders for this type of equipment were next to the largest number in the types ordered. Last year, the total of 131, or 15 per cent of the total, placed this type of passenger equipment fourth with respect to the number of cars ordered. Orders for rail - motor equipment were omitted in calculating the percentage figures.

The year's largest group of orders was placed by three Van Sweringen lines, as in the case of freight cars and locomotives. The orders were for a total of 131 cars—71 for the Chesapeake & Ohio, 40 for the Erie and 20 for the Pere Marquette. The other principal buyers



Freight car orders from 1901 to 1930

were the Pullman Company, 94, including 60 sleeping cars; the Reading, 80, including 70 multiple-unit cars; the New York Central, 50 milk and 10 dining cars, and the Long Island, 45 multiple-unit cars.

Table IV—Freight Cars Built Each Year Since 1913

Year	United States Domestic	United States Foreign	United States Total	Canadian Domestic	Canadian Foreign	Canadian Total	Grand total
1913	176.049	9,618	185,667	22,017	....	22,017	207,684
1914	97,626	462	98,088	6,453	..	6,453	104,451
1915	58,226	11,916	70,142	1,758	2,212	3,970	74,112
1916	111,516	17,905	129,421	....	....	5,580	135,001
1917	115,705	23,938	139,643	3,658	8,100	11,758	151,401
1918	67,063	40,981	108,044	14,704	1,960	16,664	124,708
1919	94,981	61,783	156,764	6,391	30	6,421	163,185
1920	60,955	14,480	75,435	....	....	....	....
1921	40,292	6,412	46,704	8,404	745	9,149	55,853
1922	66,289	1,126	67,415	458	100	558	67,973
1923	175,748	2,418	178,166	....	....	....	....
1924	113,761	1,141	114,902	1,721	....	1,721	116,623
1925	105,935	3,010	108,945	....	....	....	....
1926	88,862	2,771	91,633	1,645	....	1,645	93,278
1927	63,390	1,087	64,477	2,851	....	2,851	67,328
1928	46,060	938	46,998	5,158	....	5.158	52,156
1929	82,240	3,168	85,408	8,557	....	8,557	93,965
1930	75,188	1,909	77,097	6,923	....	6,923	84,020

The number of passenger train cars built during 1930 for domestic service in the United States was 1,264, as shown in Table VI, almost the same as the production figure for 1929, but slightly below the corresponding totals for other years since 1922. Construction of 40 passenger cars for export from this country doubled the 1929 export production figure of 20 cars; while Canadian production, of cars for use in Canada, totaled 210, and exceeded by a wide margin the 162 cars built for the same purpose in 1929. As in the case of other equipment statistics, it is necessary to bear in mind the difference between figures showing cars ordered and those showing cars built.

Table V—Types of Passenger Equipment Ordered for Use in the United States and Canada

Type	1927	1928	1929	1930
Coach, combination passenger, etc.	760	553	382	227
Sleeping, parlor, chair, etc.	238	322	654	246
Dining	111	123	111	48
Baggage, express, mail	422	502	506	131
Express-refrigerator	2	30	505	0
Milk	45	600	30	50
Horse	17	49	40	10
Private, business, miscellaneous	108	55	37	1
Multiple-unit coaches and trailers	52	30	160	157
Rail-motor cars	164	163	132	53
Rail-motor-car trailers	25	22	21	9
Total	1,944	2,449	2,578	932

Table VI—Passenger Cars Built Each Year Since 1913

Year	United States Domestic	United States Foreign	United States Total	Canadian Domestic	Grand total
1913	2,559	220	2,779	517	3,296
1914	3,310	56	3,366	325	3,691
1915	1,852	14	1,866	83	1,949
1916	1,732	70	1,802	37	1,839
1917	1,924	31	1,955	45	2,000
1918	1,480	92	1,572	1	1,503
1919	306	85	391	160	551
1920	1,272	168	1,440	...	.
1921	1,275	39	1,314	361	1,675
1922	676	144	820	71	891
1923	1,507	29	1,536	...	...
1924	2,150	63	2,213	167	2,380
1925	2,363	50	2,413	...	...
1926	2,184	102	2,286	285	2,571
1927	1,785	50	1,835	126	1,961
1928	1,356	15	1,371	237	1,608
1929	1,254	20	1,274	162	1,436
1930	1,264	40	1,304	210	1,514

Names on British Locomotives.—When James I was made King of England about 1603, he brought with him from Scotland his much admired court jeweler, George Heriot, whom he familiarly nicknamed "Jingling Geordie," a sly reference to his wealth. Now, the London & North Eastern has named a locomotive in honor of George Heriot, who bequeathed the bulk of his fortune to the magistrates and clergy of Edinburgh, Scotland. The locomotive is a superheated "Scott," Class 4-4-0, No. 9421, and was built at Cowlairs in 1914. The name "Jingling Geordie" is painted on its side. There is also a Pacific type locomotive on the same road, No. 2751, called the "Humorist."—N. Y. C. Magazine.

Baltimore & Ohio 70-ton, 65-ft. mill-type gondola car with Duryea cushion underframe—Built by Bethlehem Steel Company

A Fight for Your Jobs

THE Association of Railway Executives at a meeting at New York on November 20 formulated a definite program of proposals which the railroads will unitedly push in order to cope with the unfavorable state of railway earnings and traffic. This program is of vital interest to all railway employees. The future security of their jobs depends upon the success with which these proposals for changes in the attitude of public regulatory bodies and of the public toward the railroads and competing transportation agencies are carried into effect.

The Program

The program formulated for the railways by the Association of Railway Executives is as follows:

1—A respite from rate reductions and suspensions by regulating bodies, both intra and interstate, and from action that will increase the expenses of the carriers.

2—A respite from legislative efforts of either the national or the State legislatures that would adversely affect rates or increase the expenses of the carriers.

3—A withdrawal of governmental competition both through direct operation of transportation facilities, as well as indirectly through subsidies.

4—A fairly comparable system of regulation for competing transportation service by water and on the highways, involving affirmative legislative action as follows:

As regards water transportation, legislation should cover.

A—Extending jurisdiction of the Interstate Commerce Commission over port to port rates, to include—

B—Determination of just and reasonable rates, and prohibition of discriminatory and unduly prejudicial rates.

C—Publication of and adherence to rate schedules.

D—Proper service requirements.

E—Certificates of public convenience and necessity after proper showing.

F—Opportunity for railways to enter this field of transportation under proper supervision, but without handicap as compared with other transportation agencies. The Panama Canal Act should be modified so as to permit railroad operation of waterway service in conjunction with rail service.

G—And, in addition to affirmative legislative action, the retention of the flexible character of section 4, Interstate Commerce Act, sympathetically administered, with fair opportunity on the part of rail carriers to obtain relief after proper showing and including transcontinental traffic.

As regards commercial highway transportation, by bus or truck, legislation should cover—

A—Extending jurisdiction of the regulatory authorities over commerce carried by such agencies.

B—Certificates of public convenience and necessity after proper showing.

C—Proper protective requirements for financial responsibility and surety bonds or insurance.

D—Adequate requirements for just and reasonable rates, both maximum and minimum, with provision for publication thereot and adherence thereto, and proper inhibition against undue and unjust discrimination.

E—Proper service requirements.

F—Adequate authority for rail carriers to operate such facilities, without discrimination in favor of other transportation agencies in the same field.

G—Adequate provision for privilege or license fee imposed on all motor vehicles for hire or profit using highways, so as properly to participate in construction and maintenance costs of highways.

That the program of the railroads is not a blindly selfish or unfair attempt to better their own situation at the expense of the public is clearly indicated by the following paragraph from the executives' statement:

"In so far as any form of the above service is legitimate, and a natural economic development, the railroads have no right to complain. The public is entitled to the best transportation at the lowest reasonable cost. However, where the rail carriers are prevented through legislation or regulation from fairly competing with new or old forms of transportation, or where the service rendered by the competitor is a subsidized one, such unfair handicaps should be removed."

In order that our readers may acquaint themselves with the facts pertaining to the situation which the railroads are facing and determine for themselves whether or not the program of the executives is fair, various phases of this situation will be discussed on this page in future issues.

The fight of the executives for fair treatment is no more in the interest of the corporate welfare of the railway companies than it is in the interest of the employees. The future of both depends upon healthy conditions in and affecting the industry. Let every employee inform himself and join in the fight for a square deal for the railways!

EDITORIALS

An Enginehouse Staff With Three Objectives

The first of last year the enginehouse staff of one railroad set three objectives to be achieved during the year. The first was cleanliness and good housekeeping, the second, to decrease engine failures, and third, reduce expenses.

With respect to the first objective, we quote direct from a report for the month of November: "From the inspections made this month, there is no question but what everyone of the shops and engine terminals were in a very neat, clean and orderly condition. Now what must be done is to keep them in that condition. A place for everything and everything in its place."

As to decreasing engine failures, a comparison of the actual number of failures during the month of October with those of January, shows a decrease of over 44 per cent. The percentage of defective locomotives reported by federal inspectors was reduced from a maximum of 39 per cent to 8 per cent.

Naturally, the third objective, to reduce expenses, was to keep the expenditures of the motive power department in line with the reduced income of the railroad which all railroads are experiencing at the present time. The economies effected thus far were accomplished, as evidenced in many respects by the results of the first two objectives, without seriously impairing the efficiency of engine terminal operations. The stressing of these three objectives has affected economies in practically all of the other terminal operations. Give a man a clean and orderly place in which to work and the management can accomplish wonders.

Lubrication Research Needed

It is apparent that the work of the A. R. A. Committee on the Lubrication of Cars and Locomotives has about reached the point where laboratory research and investigation is needed. Its work thus far has been exceedingly fruitful. Four years ago the average car-department officer thought his road was getting wonderful results if it produced a record of 20,000 freight-car-miles per hot box and one million passenger-car-miles per hot box. Today, he is unhappy unless he is approaching 50,000 freight-car miles and over two million passenger-car-miles per hot box. One road in the east recently attained a record of over 200,000 miles per hot box on freight cars.

Considerable of what has been accomplished can be credited to the adoption of A.R.A. Rule 66. Thus far this rule has been an important factor in improving the hot-box situation. However, there are a number of mechanical-department officers who believe that Rule 66 can be made more effective if it includes a provision whereby bills can be refused for repacked boxes which must be packed again within sixty days.

To date, the work done by the committee has been entirely of a practical nature. It has made recommendations for the renovation of packing to meet A.R.A. requirements. It has formulated rules pertaining to the correct packing of journal boxes and has outlined a procedure for the instruction of box packers. It has made an intensive study of the causes of hot boxes and is now investigating the possibilities of an all-year oil as a substitute for the winter and summer oils which the majority of railroads are now using.

Several producers of lubricating products have undertaken, or are contemplating, a series of laboratory studies of car lubrication. These tests will be of value to the industry and the results will be of considerable assistance to the Lubrication Committee. However, an accurate knowledge of the part mechanical defects play in causing hot boxes is undoubtedly of as great importance from the standpoint of the railroads as a knowledge of the lubricating characteristics of various oils under varying operating conditions.

There is no reason why a testing machine cannot be designed on which a variety of mechanical defects can be set up for laboratory investigation. Such an investigation, supplemented by the oil tests being contemplated, together with such data as have already been assembled by th A.S.M.E. Special Research Committee on Lubrication and by a number of other technical societies, should be of material assistance in continuing the improvement of journal-box conditions.

Engine Failures Due to Faulty Material

The number of locomotive-miles operated per engine failure is an index of mechanical department efficiency watched with the keenest interest by mechanical and operating department officers on all roads. Generally speaking, locomotive performances in this particular are now being secured which would have been considered impossible a few years ago. Engine failures still occur, however, and the embarassing nature of engine failures is familiar to every locomotive department officer. How they dread to see an epidemic get started of failures in one particular detail! For weeks, and sometimes months, after the correction of the original difficulty, engine crews and operating department forces avidly seize upon the opportunity to blame every possible delay caused by their own deficiencies against that particular locomotive defect.

Material failures are, of course, generally due to the use of incorrect materials, materials improperly made, or those used in such a way as to constitute abuse. Some highly pertinent comments regarding this subject were contained in a paper presented by Dr. William M. Barr, consulting chemist, Union Pacific, before the Pacific Railway Club early in 1930. Doctor Barr stressed the necessity of strictly following specifications in the replacement of worn-out or broken parts, in order to avoid the failure of steel parts, for example, which may give every appearance of duplicating the original part, but, in reality, do not have the requisite physical characteristics.

The necessity of careful handling of steel or locomotive parts in all phases of their manufacture and fabri-

cation can hardly be overemphasized. Doctor Barr calls attention to a number of specific instances in which such care was not exercised. A few of these include a forging of correct chemical composition, but with a serious internal rupture, developed during the process of manufacture; a crank pin, unsound, due to being made from steel cut too close to the top of the ingot; a broken driving rod, due to a progressive fracture, developed from an internal structural defect; rod failures from progressive fractures, due to sharp fillets, rough cuts or surface imperfections caused by mishandling; flue sheets cracked, due to improper practice in flanging; steel castings and forging welded without the proper allowance for expansion and contraction, or giving due consideration to the effects of heat on the internal structure of the metal itself.

Alloy steels are usually considered more "temperamental" than plain carbon steels, but, after acknowledging that structural defects, such as pipes, gas pockets, and segregations, were found in many alloy steels when first offered to the railroads, Doctor Barr paid tribute to the improvements effected by the alloy steel manufacturers in the following words: "It is now possible to get sound forgings, even in the largest sections, as readily as with plain carbon steel."

There is a great need for further earnest and intelligent study of the characteristics and limitations of all kinds of steels by railroad men in order that this basic material may be used, not blindly, but with maximum efficiency in the service of the railroads and the country at large.

Cleaning Freight Cars Is a Real Problem

The cleaning of freight cars and putting them in condition for the satisfactory transportation of high-class, as well as lower-grade, commodities constitutes a real problem. It is an item of expense of no mean proportions, even after the installation of adequate cleaning facilities, which, for the best results, should comprise cleaning tracks fully equipped with air, steam, water and drainage lines. The initial cost of this equipment may well amount to several thousands of dollars for a relatively small installation, considering both labor and material costs, including the expense of carefully lagging steam lines to save fuel, and water lines to avoid freezing in cold weather.

Unquestionably, railroads are called upon to perform more extensive car-cleaning operations at greater expense now than ever before. Car-department officrs state than an ever-increasing number of shippers are becoming over-technical and are refusing cars which would have been accepted as meeting the requirements of their particular commodities a few years ago. Railroads generally recognize their responsibility for furnishing cars clean and in good condition to handle each class of commodity without resultant damage or taint. They should not be expected, however, to furnish cars of a higher grade than required, particularly when commodities such as hides, oils, greases, etc., are to be loaded. Not only does this necessitate a lengthy and expensive cleaning operation, but sometimes the equipment is put permanently out of commission for subsequent high-class loading, with resultant substantial loss to the railroad.

In general, the railroads provide three classes of car-cleaning operations, the first of which includes sweeping out and blowing with air, accompanied by the removal of loading blocks, wires, nails, etc. The second class covers all the work performed in the first, with the addition of washing out with cold water. The third class is the same as the second, with the exception that the car is washed with hot water and steam, using a cleaning compound and disinfectant when necessary. Inasmuch as it is good economy to clean freight cars always with a view to returning them to as high-class service as possible, the problem of removing oil and grease spots from floors and inside linings is an important one, and considerable pertinent information regarding this phrase of car cleaning is provided by F. J. Swanson, district master car builder of the Chicago, Milwaukee, St. Paul & Pacific, in a recent paper before the Chicago Car Foremen's Association, abstracted elsewhere in this issue.

The relative merits of different methods for eradicating grease or oil spots, as mentioned in the paper, are more or less in dispute and, judging from the discussions at conventions and elsewhere, it is apparent that an entirely satisfactory way of removing oil spots has not yet been developed. The burning process is not always applicable, but it would appear from Mr. Swanson's paper that it is practical in the majority of cases, provided proper care is exercised by the operators of the flame. The fact that cars cleaned by this process are satisfactory to the flour shippers of Minneapolis is significant, as flour is more susceptible to contamination from oil that almost any other commodity. Therefore, the information in Mr. Swanson's paper should lead to additional experiments along the same lines.

An essential feature of any car-cleaning operation is the cost per car. Many of the diversified figures quoted by railroad men are so far out of line as to justify the assumption that all details of cost are not taken into consideration in every instance. If some semblance of uniformity could be established to serve as a guide in arriving at the actual cost, it would, no doubt, prove beneficial in making comparisons and promote the increased use of the most economical and effective method.

What Is Reclamation?

A recent report on the reclamation activities on a certain road contained the following two paragraphs: "During the year our valve repair shop reclaimed 2,120 angle cocks, 2,587 cut-out cocks of various sizes, 981 drain cocks, 36 stop cocks, 5,701 globe valves, * * * * The tin shop takes all old —— roofing that is received from the entire railroad and uses it in the manufacture of fire buckets, mileage marker signs, metal flags, signs, smoke jacks, stove pipes, etc. In this building we repair switch lamps, train-order lamps, in fact all classes of lanterns and tinware. Pipe fittings are reclaimed. Flexible joints, shovels, track gages, post-hole diggers, stove castings, etc., are placed in first-class condition and returned to stock." Another part of the report stated that coupler rivets were made out of old 1⅛-in. beam truss rods and that all coupler yokes are made out of scrap material.

The above statements, selected at random from the report, characterize three things that may be questioned in connection with reclamation as the practice is viewed on some railroads—the fact that some reclamation operations are actually manufacturing, that others indicate the segregation under another roof or department of normal

shop repair work and that the reclamation idea is carried so far as to be of questionable value.

In an editorial in the *Railway Mechanical Engineer* a short time ago reference was made to a case where one road had issued orders to hold up reclamation on many items until an investigation could be made of the actual cost of the work and the savings, if any, that might be expected. Since that time other cases have come to our attention where the reclamation plant is being viewed more critically than it was when actual savings were less important than they are under present conditions. The railroads have been criticized in many cases for entrance into the manufacturing field and it would seem highly desirable to make careful cost analyses to determine whether or not the manufacturing of parts or utensils from scrap material in a reclamation plant is justified. There would seem to be some question whether or not such items as fire buckets, metal signs or stove pipes could be made of any kind of material as cheaply as they could be purchased. Then again what about quality and serviceability?

An analysis of the report in question revealed the fact that a great part of the work being performed in the reclamation plant was actually nothing more nor less than normal repair work performed day in and day out in any railroad shop. Why take it out of the shop and put it in the reclamation plant? Possibly the normal major repair operations of any shop could be materially improved if this kind of work were taken out of the departmental groups and placed in another department with special machines and trained men to do the work. But why call it reclamation?

The manufacture of coupler yokes and coupler-yoke rivets out of scrap materials would seem to be a most extravagant kind of economy. Metals sooner or later reach a limit of economic usefulness, for fatigue so changes their physical structure as seriously to affect their ability to withstand stresses. The draft gear on any car or locomotive in main-line service is an extremely important unit and one or two train delays from pulled-out drawheads can wipe out any savings effected by using scrap material instead of new.

The entire problem of reclamation is worthy of careful consideration from a mechanical department standpoint. In many cases extravagant claims are made as to the savings that are effected by reclamation but investigation often reveals that the savings are more theoretical than actual. In any event the mechanical department pays the bills in the long run.

Power for Heating and Cooling Passenger Cars

In an article elsewhere in this issue which discusses the basic requirements for cooling and conditioning the air for railway passenger cars, the author compares the requirements for heating and cooling passenger cars in terms of horsepower. His statement would make it appear that from seven to ten times as much power is required to heat a train under the most severe winter weather conditions as is required for the effective cooling of a dining or sleeping car in severely hot summer weather. The figures used are 100 hp. for heating and 10 to 13 hp. input for the refrigerating plant for cooling.

Considered on a thermal-unit basis, the 100 hp. for heating represents approximately the requirements for a passenger coach with a difference of temperature inside and out from 70 to 75 deg. Since the amount of heat transferred from the steam supplied to the car is well over 1,000 B.t.u. per pound, it requires but little more than two pounds of steam to supply the car with the heat-unit equivalent of one horsepower. It is evident, therefore, that the steam required to heat a passenger coach represents but a fraction of 100 hp., delivered at the drawbar.

Tests indicated that the modern steel passenger car can be heated with about 2.85 lb. of steam per hour per degree difference of internal and external temperature. With an assumed temperature difference of 75 deg., a 15-car train would require about 3,200 lb. of steam per hour. As many passenger locomotives will produce a maximum of 40,000 or more pounds of steam per hour, the maximum steam-heat load of a 15-car train represents hardly more than 8 per cent of the locomotive boiler capacity. There would appear to be no great difference in the load on the locomotive required for heating or for cooling passenger cars, respectively under severe winter and summer weather conditions. The exact relationship will, of course, depend somewhat on the efficiency with which energy is converted into mechanical work at the car refrigerating plant.

NEW BOOKS

Book of A.S.T.M. Standards. *Published by the American Society for Testing Materials, 1315 Spruce street, Philadelphia, Pa. Two parts. Bound in cloth, $14; bound in half leather, $17.*

The 1930 edition of the Book of A.S.T.M. Standards, which is issued trienially, is in two parts, Part I of 1,000 pages containing 179 standards adopted by the society relating to metals, and Part II of 1,250 pages containing 251 standards adopted by the society relating to non-metallic materials. The 1930 edition of the Book of Tentative Standards, published annually, contains 155 tentative standards in effect at this time, and can be obtained for $7, paper bound, or $8, cloth bound. The standards are grouped according to the materials to which they apply.

Proceedings of the International Railway Fuel Association. *Published by the International Railway Fuel Association, 700 La Salle Street Station, Chicago. 568 pages, illustrated. 6 in. by 9 in. Flexible red-leather binding.*

The proceedings of the 1930 convention of the International Railway Association, which was held at Chicago May 6 to 9, indexes reports on Steam Turbine Locomotives; Diesel Locomotives; Front Ends, Grates and Ash-pans; New Locomotive Economy Devices; Locomotive Firing Practice, both oil and coal; Inspection and preparation of fuel; fuel Conservation Bulletins and Cartoons; Fuel Distribution and Statistics; Classification of Coal; Storage of Coal and Oil; Locomotive Fuel Stations, and Stationary Boiler Plants, both coal and oil. The addresses presented at this convention were by W. J. Tapp, fuel supervisor, D. & R.G.W.; J. S. Pyeatt, president, D. & R.G.W.; Samuel O. Dunn, editor, Railway Age; C. E. Bockus, president, National Coal Association; F. H. Hardin, assistant to president, N.Y.C., and R. E. Woodruff, vice-president, Erie. Papers were presented also by H. N. Rodenbaugh, vice-president, F.E.C., whose topic was "Should the Railways Expect Decreased Fuel Costs?"; D. L. Forsythe, St. L.-S. F., who discussed "Locomotive Operation in Extended Service", and J. C. Nolan, Gulf Coast Lines, who discussed "Lignite Coal".

THE READER'S PAGE

A Question On Rule 17

To the Editor:

Rule 17, Section (c) protects the size of coupler butt. The equipment on one of A's cars includes a coupler with a 5-in. by 5-in. shank and an 8½-in. butt and is so stenciled on both ends of car. B applies an A.R.A. Type D coupler with a 5-in. by 5-in. shank and a 9⅛-in. butt as existing arrangements of sills and drafts are suitable. Does B make wrong repairs because he applies a coupler with a 9⅛-in. butt instead of the one with an 8½-in. butt which is standard on the car in question?

J. A. Garner.

A Bit of Warmth In a Cold Winter

To the Editor:

We have got to hand it to the sales engineers, fourteen of whom have called on me already this year, each one appearing with the same glad old spirit of prosperous days, looking and acting as though business was never better. In conversation, all declared that better times are just around the corner and refused to listen to all tales of gloom.

While one has a job that will at least buy bread and butter for himself and the kids, some of these "heroes" of the road when pressed for actual facts will acknowledge, if they are real intimate acquaintances, they haven't booked an order for five months. Therefore, I say, let us try and find time for a little cheerio visit when they call and, even if not in the market for anything, take time to tell them so in a courteous manner, for these boys can surely do with a little extra friendliness at this time.

If you have never done so before, start now and invite one over to the house for lunch, or to spend an evening once in a while. It won't cost much, but will make a heck of a difference to some good chap's outlook.

Shop Superintendent.

How to Detect Loose Wheels

To the Editor:

I note, in your January number, that the loose wheel has again bobbed up. In the case of an indication of possible looseness, it is necessary to establish beyond doubt that the wheel is not loose, or the car must, in the interest of safety, be set out. The quickest and easiest way to determine this is to examine the junction of the hub and the axle at the back of the wheel for indications that the wheel has moved on the axle seat. If there is an unbroken binding film between the wheel and the axle, it is a sure indication that the wheel is not loose, notwithstanding that there may be oil seepage indications on the back of the hub. As a matter of fact, oil seepage is of rather frequent occurrence, usually due to small grooves ploughed into the surface of the wheel seat during the pressing-on process.

Since a binding film is so important in such cases, it is also important that no pressed-on wheels leave the wheel shop without such a paint film. If a sufficient amount of the paint has not been pushed ahead during the pressing-on process to produce a good binding film, the deficiency should be remedied by applying the paint film by brush or otherwise.

In the case of chilled iron wheels, this paint film will ordinarily last from pressing to pressing. If, however, the wheels are shopped for other than press work, the back of the fit should be examined, and if there is not present a clearly-defined film, paint should be applied to form one.

In the case of multiple-wear steel wheels, however, the film will ordinarily have been destroyed by weather, abrasive action of sand, cinders, etc., long before the wheels are due for pressing off. Thus, on such wheels there may be some doubt as to their being loose, particularly with the presence of brown rust stains at the back of the fit, more or less peculiar to this type of wheel.

An excellent practice is to apply a new paint film at the back of the fit, when wheels come to the shop for turning or other work, this, of course, after proper inspection to establish the fact that the wheel is not loose.

Assistant Master Car Builder.

A Rational Reclamation Program

To the Editor:

The editorial, "Does It Pay To Reclaim?" published in the September issue of the *Railway Mechanical Engineer,* raises an important question.

During the war period one railroad with which I am familiar went into the reclamation business on a large scale. Reclamation platforms were erected (presumably without thought of the cost) at practically every point where repairs were made to cars or locomotives with the ultimate result that what might be called two distinct storehouses were established—one for new material and one for second-hand or reclaimed material.

The car foreman took delight in piling up reclaimed springs, follower plates and blocks, brake shoes, bolts, rivets and miscellaneous car parts upon platforms. In many cases the bins or platforms required additional bracing every now and then to keep them from giving way under the excess weight. I say they took delight in accumulating this material because they submitted a monthly statement showing the amount of money saved from the scrap pile, minus the actual cost of reclamation. Quite frequently they received commendation from the mechanical department officers for having accumulated so much from the scrap pile.

This material could be drawn out without cost by the car repairer. It was a rule that he must visit the reclamation platform regardless of the piece of material which he desired to obtain. If, by chance, the item was not in stock, a material card was issued by the attendant which authorized withdrawal of new material from the storehouse.

One day the mechanical department on that road woke up. Someone took an inventory of reclaimed stock and it was found that about 75 per cent of it was not moving because it was obsolete. They found that such items as draft-gear and truck springs, coupler yokes, forgings, grab irons, sill steps and many other parts had greater value as scrap than as usable material. Many of the draft gears which they had been saving were solid due to wear and would provide about the same cushioning effect as an ordinary oak block.

The majority of this so-called reclaimed material was consigned to the scrap pile and the business of dismantling the reclamation plant was begun.

We should ask ourselves the following questions: Where did the good rivets, bolts, nuts, washers, safety appliances, etc., which were sent to the reclamation plant for stock, come from? Is it not probable that too many were drawn out of the storehouse for some particular repair job and that those left over had been picked up and sent to the reclaiming platform for stock? Didn't they cost just as much at the reclamation platform as they did at the new material storehouse, even though they were used at a later date? If draft-gear and truck springs, as well as the gears themselves, were worth reclaiming why were they not applied on the particular car from which they were removed at the time it was undergoing repairs?

While it is true that some parts, such as couplers with bent shanks, and other parts which can be straightened and reclaimed at the blacksmith shop should be reclaimed, I believe that the time to reclaim material is not after it is placed in the scrap heap, but at the time it is removed from the car. It should be inspected by a competent inspector and either marked for reapplication or scrapped.

Those parts requiring repairs before they can be used again should be passed on by the foreman in charge of the shop or his appointed representative, who should take into consideration the cost of reclaiming plus the overhead expense and the serviceability of the part after it has been repaired. By adding the scrap value of the item to this total, in many cases it will be found that the total cost will equal or exceed the original or storehouse price of the new part.

E. E. Evans.

Who Belongs to This Organization?

To the Editor:

"Which Man Would You Hire?" is asked on page 638 of the November issue. If all foremen's organizations are like one I have become acquainted with, I would unhesitatingly take the "non-joiner", but I feel that perhaps the one herein described is an exception.

A greater amount of self satisfaction and esteem than these fellows possess I have never seen. They meet once a month, or more often, to discuss how clever they are and how poorly managed their railway is. Only two of them subscribe regularly to any trade journal. None is enrolled in any home study course and each appears to be far more interested in comparing how many overtime hours he is called on to work rather than any privileges he may enjoy. If it is discovered that some other railroad pays higher salaries than they receive, they have a subject for discussion at the next several meetings. Should an exceptionally large output be effected some week, they fill up with pride of personal accomplishment, but on the occasion of an admittedly poor one they can immediately prove to their own satisfaction that it was the fault of the stores department or some influence or other entirely outside of their control.

So, I repeat, when you have a man with the desired capacity for a supervisor who refuses to affiliate with that sort of an organization, he would be the most likely one to choose. Would it not be well to ask "A Job Hunter" to describe the kind of a foreman's organization he has in mind?

Master Mechanic.

Are Two Men Ever Alike?

To the Editor:

A correspondent, on page 638 of the November issue asks, "Which Man Would You Hire?". The statement that "two men with the same qualifications and experience applied" is what leads me to offer my comments for I do not believe it possible that two men could have the same qualifications.

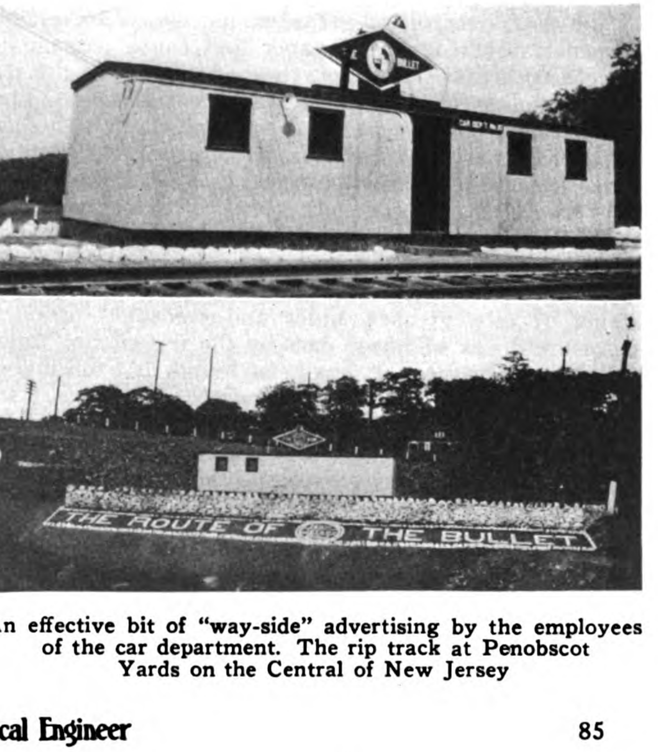
In my twenty-five years of contact with railway shop supervisors, I have never come across two men having qualifications anywhere near similar, and were one a "joiner" or not, there has always been plenty of differences in age, personality, experience, capacity, etc., to enable one to pick the best man. A man may not be a joiner, but by the expenditure of probably five dollars could become one, may be spending for his improvement more than that amount every week.

I would inquire as to his reason for non-membership in an organization that was admittedly functioning for the purpose of training supervisors to become real masters of their present jobs and fit candidates for any promotion that could possibly be offered them. Were it shown to be merely a matter of indifference or that he was sufficiently well pleased with himself without making any extra effort to keep abreast, he most certainly would have a small chance for the vacant job.

I wonder if this answers "Job Hunter's" question?

A Job Holder.

* * *



An effective bit of "way-side" advertising by the employees of the car department. The rip track at Penobscot Yards on the Central of New Jersey

With the Car Foremen and Inspectors

Removing Oil and Grease Spots*

By F. J. Swanson†

MORE or less animal hides, oils and greases are being transported in high-class house cars, resulting in these cars not being fit for high-class loading until cleaned. Several different methods are employed by the railroads in cleaning their cars and removing oils, grease spots, etc.

Good success in removing oil and grease spots in car floors is obtained by using the gasoline blow torch with the flame directed on the spots. Heat causes the oil to come to the top surface of the floor, where it is evaporated and burned. The operator, if fully experienced, can tell when all the oil has been removed. This practice does no damage whatsoever to the car floor as far as burning is concerned. The slightly charred part of the floor is scraped away by the operator by using a metal scraper or wire brush. This is all swept out of the car. When the operation is completed, the car is fit for any high-class lading, such as flour, grain or food products.

Several manufactured products are being used by various railroads for the removal of oil and grease spots, but they are still in the experimental stage. Careful studies and tests should be made or continued in order to solve this phase of the car-cleaning problem.

Some tests have been made of manufactured paints or alcohol paints which have not proved entirely satisfactory, especially when used during sub-zero temperatures when the paints do not seem to dry but become sticky.

Asphaltum paper has also been laid or placed on top of the floor over oil or grease spots, which are unable to penetrate through the paper and cause damage to the car contents. However, the possibilities of the paper becoming torn or missing are considerable. This paper could possibly be used or applied to high-class cars which are used for mixed commodities, such as oils, greases, hides, oiled machinery or oiled sheet steel, thus eliminating the possibility of the grease or oil spots and keeping the car fit for high-class loading when empty.

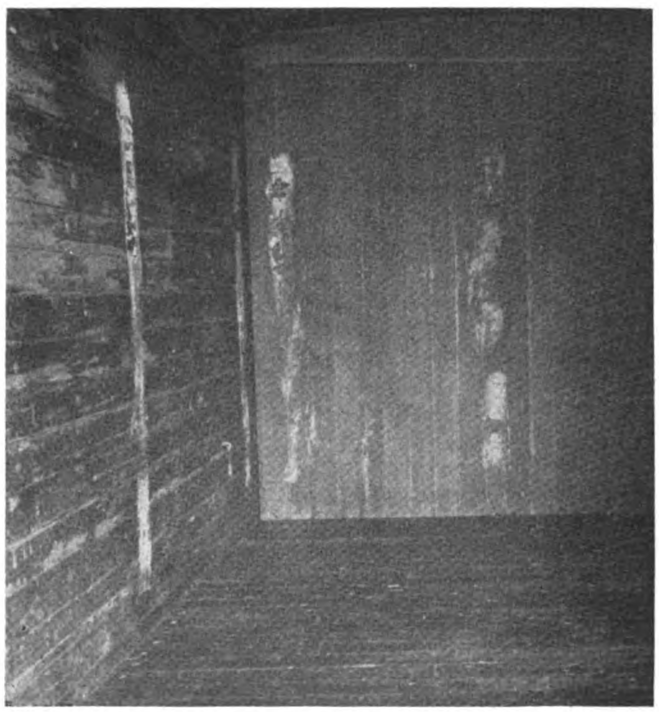
Much success has been obtained in removing the stains of oils, greases, hides and creosoted products from the floors of house cars by the use of hot water and steam pressure. It has been found that the higher the pressure, the better the operation. The use of superheated steam naturally produces a more dry heat which has a tendency to burn up the oil or grease spots. This also causes softening or thinning out of the oil, the force of the steam pressure assisting in removal of all foreign material from the car.

There are several manufactured products on the market that can be used in connection with hot water or steam. The Milwaukee has used successfully soda ash with steam in removing oils and greases; also caustic soda with steam pressure in removing the trace of green hides and creosote. The soda ash and steam, used a second time, makes a favorable job, but we have found slight odors left in the car, which, in our opinion, leave the car after a certain period of time. Then, again, we are entirely successful in removing the material as well as the odor. It depends on how long and how much is left or found on the car floors. With a good, high steam pressure, using a superheated steam boiler with dry steam up to 700 or 800 deg. F., cars can be cleaned perfectly.

It is also understood that creosote can be removed from car floors by using alcohol or naphtha, the latter preferred on account of being cheaper. It is understood that the car should be washed out also with hot water or steam. Creosote is made up from coal products and, if a little odor is left in the car, it will not do any harm, disappearing entirely in time.

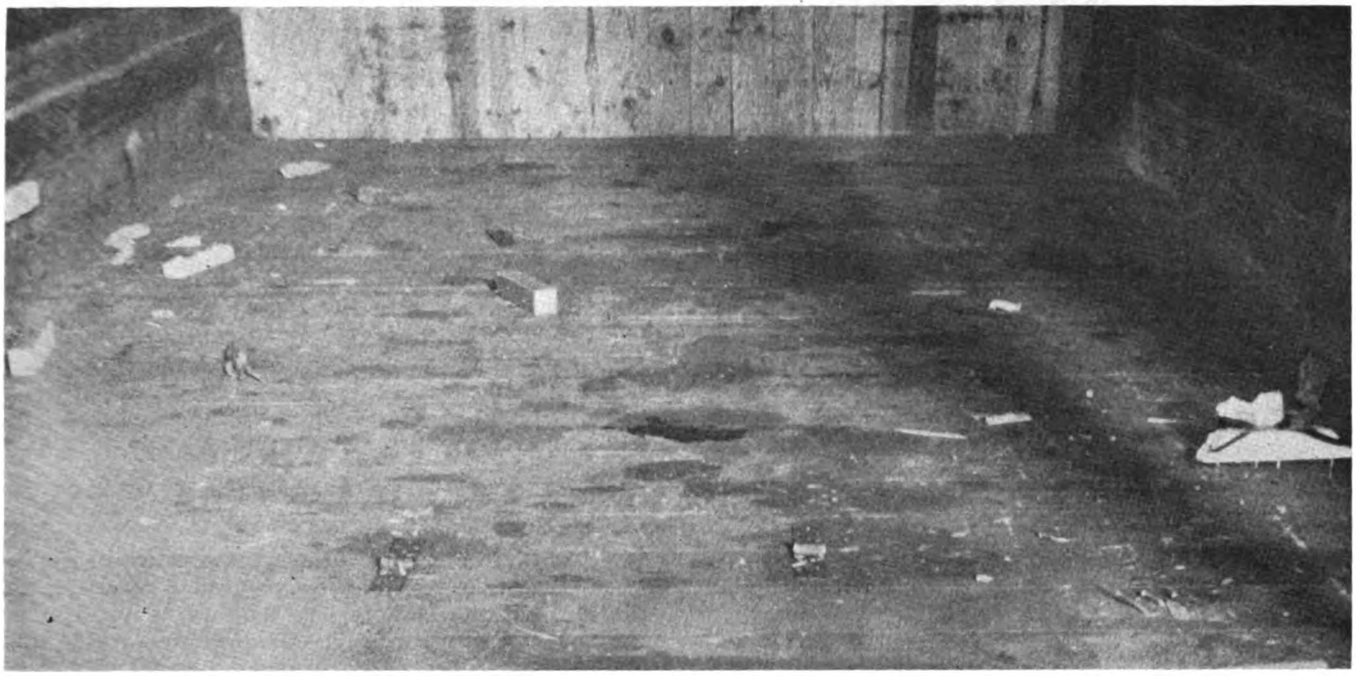
Several railroads are removing flooring and, in some cases, inside lining when found saturated with oil or grease spots. This is an expensive operation. If the flooring is in good condition, it usually means an expense of at least $80 per car if the entire floor is removed. Some method should be employed to save this expense.

In using strong steam pressure or hot water, it should not be used excessively, as the fiber of the wood raises, causing what is known as "rough floors," which are objectionable, resulting in damage to contents. If,



One corner of a house car which has been cleaned and washed ready for high-class loading

* Abstract of a paper presented before the December meeting of the Car Foremen's Association of Chicago.
† Mr. Swanson is district master car builder of the Chicago, Milwaukee, St. Paul & Pacific.



Oil spots, cleats, steel straps and nails must be removed from this automobile car floor

however, any such cases arise, the condition can be readily remedied by using or having some sort of an electric or air-driven planing machine go over the rough or splintered parts of floors.

Every one appreciates the importance of having clean equipment furnished the shipping public. Therefore, it is very important that we do our utmost to see that the work is done as nearly perfectly as possible through different operations and tests. Supervision of the work should be handled by the car-department forces, always with the thought in mind of giving maximum service to the shippers and traveling public.

Discussion

J. E. Mehan (assistant to superintendent car department, C. M., St. P. & P.): How about burning out oil spots with a gasoline torch, scraping or sweeping off that char and cleaning it out of the car, painting over that black charred spot with quick drying paint? How long has Mr. Swanson been using this gasoline torch? And has he had any case of a car catching fire? I would like to have Mr. Swanson bring out these points.

Mr. Swanson: We have an operator at Minneapolis that's been doing it for the last five years. He is very efficient. He has made himself a pad he places over his knee, kneels down and directs the flame at the oil spot and it is remarkable to see how that oil will siphon up through the floor. He knows when to stop, he does very little damage, if any, to the floor. Probably he gets a little burned spot on top and takes a scraper and removes that. Formerly we did not paint over those spots, but it was suggested that we use a quick drying paint, which we are now using. We are having very good success with it. A test was made to determine if this operation was practical. After we got through with the car we took the regular paper used by the flour mills, heated some sand to a certain degree, warm enough so you couldn't stick your hand in it, left that paper and sand on that spot for about three hours. We came back and there wasn't a spot underneath that paper.

I know of no cases where we have caused any fires. We have a very competent man who closely watches his work. As an illustration, if the oil spot is up near the edge of the floor with possibility of the flame going up under the lining or between the lining and the siding, he has a piece of tin bent in shape from the floor up so that it prevents any flame from getting up there. This is an operation also that each supervisor watches carefully.

M. E. Fitzgerald (general car inspector, C. & E. I.): May I ask Mr. Swanson what is the average cost of cleaning of this equipment under the methods which he suggests, and if he has any figures to indicate the cost where the entire floor and side lining are thoroughly saturated due to leaking cod liver oil, etc.

Mr. Swanson: It is costing us around 78 cents a car. That doesn't take in the cost of switching or the cost of the use of steam, but the actual labor.

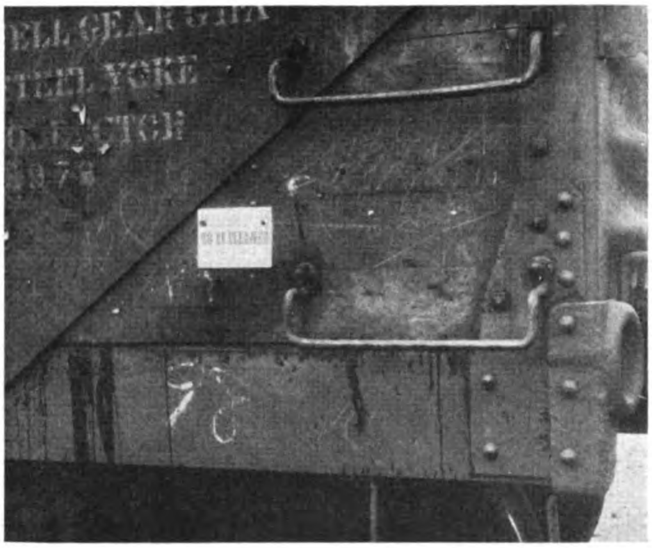
E. H. Meckstroth (general car foreman, B. & O. C. T.): If I remember correctly, Mr. Swanson stated that he removed some spots with a torch, scraped the scarred or burned spots and then painted it over. I know we have had cases where we painted the inside roof lining to remove the stains when outside metal roof had been renewed, and when a little paint was splashed on the floor shippers would object to the paint. If you paint the spot over, there being oil in the paint, it seems to me you are getting another oil spot back in the floor. Can you enlighten us on that, please?

Mr. Swanson: I think the paint we use hasn't any oil in it. (Laughter.)

Mr. Meckstroth: In that case, I would like to know what kind of paint you are using.

Mr. Swanson: We are using a quick drying paint, but I haven't heard any complaints from the shippers. It is a well-known fact, gentlemen, when they load flour they use bran in a good many cases and a couple of layers of paper. There isn't much chance of any oil seeping through the bran and the paper. They also paper the sides.

President G. R. Andersen (district master car builder, C. & N. W.): It is very encouraging to hear, Mr. Swan-



The familiar card, the application of which results in cars being switched to the cleaning track

son, that it is possible to remove oil spots regardless of how thoroughly they may be soaked into the floor. To be a little specific with the thought of getting some information that we are all interested in, I would like to ask two or three questions. First, you made the statement that you were using a torch for the removal of oil spots. Will you kindly describe just what kind of a torch is being used for this purpose? Second, I would like to ask if the price quoted of 78 cents per car is an average price. Certainly you cannot clean oil spots from an entire floor for 78 cents. Third, I would like to ask your method of removing taint, such as glue stock and salt hides.

Mr. Swanson: The gasoline blow torch we use is called the "Universal Gasoline Blow Torch." They have the half-gallon and gallon containers in connection with the torch.

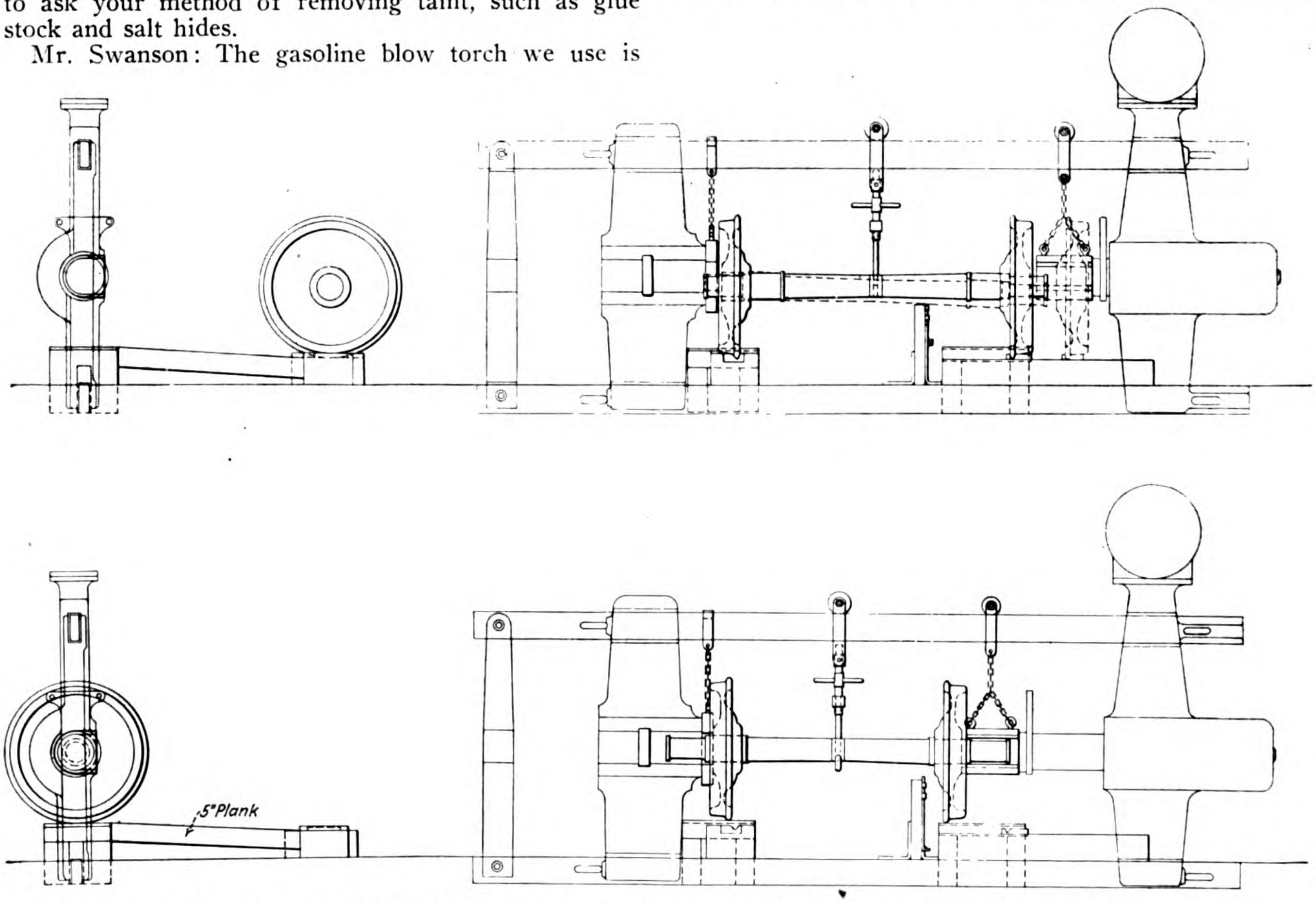
Second question. Seventy-eight cents is the average price. We have some that will cost $1.50, some $2; then again we have some that will cost less. That is the average price for the month. The more cars we clean the less our costs. I guess that is true of all operations.

In connection with the removal of taint caused by glue stock and salt hides, we have been successful in using the caustic soda and steam and then washing it out with soda ash. We have had cases where we haven't done the job 100 per cent. Again, we have had cases where we have done a perfect job.

Applying Two Wheels With a Single Pressing

MANY wheel shops follow the practice of applying one wheel to its seat and then reversing the axle to apply the mate wheel. This procedure can be improved upon with respect to time by arranging and equipping the wheel press as shown in the drawing. The wheel press is located in the shop with sufficient floor space on the loading side to install an incline of 5-in. plank and a grooved-plate flange guide as shown. It should be so placed that wheels and axles can be routed either from storage or from the axle lathes and boring mills to the press and thence with the assembled wheels and axle to finish storage, to be loaded for shipment or disposed of as desired.

The arrangement drawing at the left top shows the wheels in progress up the incline to the grooved flange



Arrangement of a wheel press for the simultaneous application of both wheels to an axle

guides. The axle is swung at the center on a monorail screw hoist, which permits the axle to be moved along the monorail, as shown. A hollow block swung on a chain and hook from the monorail holds the wheel in vertical position against the housing post of the press. The flange groove prevents the wheel from tipping or sliding away from the block. With the stationary wheel in place, the axle is then moved into position as shown in the top drawing at the right.

The mate wheel is rolled into position as shown by the dotted lines. The axle is moved to the wheel center. A block, also swung from the monorail, is inserted between the head of the press and the wheel. The movement of the press forces the grooved flange plate from right to left as shown, until the wheels start moving over the wheel seats. Then with the aid of the monorail screw hoist the wheel flanges come to rest on steel plates, as shown, which serve to keep the axle and wheels in position until both wheels are pressed on their respective seats.

Reboring Car Brasses

IN accordance with the American Railway Association requirements. all car brasses on the Chicago & North Western are being rebored 1/32 in. before relining. Most of this work is being done at the Chicago shops of the railroad, using a Henrickson car-brass boring machine in which certain modifications have been made. Those familiar with the machine, which is illustrated, will recall that the brass rests on one guiding sector along which it slides under the action of a feed screw, passing a revolving cutter which removes a certain amount of material and then onto a second guiding sector which is set higher than the first by the amount of the cut removed.

When reboring babbitt-lined brasses, only enough of a cut is taken to clean up the surface. For reboring the brasses mentioned, however, the second guiding sector is set 1/32 in. higher than the first to correspond with the increased cut being taken. It was found necessary to decrease the feed of the machine by changing the feed screw from one with a four-pitch thread to one with an eight-pitch thread.

Henrickson machine as provided with reduced feed and Carboloy cutters for boring brasses before relining

Since cast brass, with a tough skin more or less impregnated with sand, is notoriously hard on cutting tools, cobalt high-speed steel cutters were first used at a speed of 205 r.p.m. for all sizes of brass. This is equivalent to a cutting speed of 295 ft. per min. on a 5½-in. brass. Experience indicated that a production of only 100 brasses was secured per grinding of the cobalt cutters on the average.

Inasmuch as this was not a satisfactory performance, Carboloy cutters were inserted and the speed increased to 380 r.p.m., equivalent to a cutting speed of 547 ft. per min. on a 5½-in. brass. A production up to 1,800 brasses per grinding of the cutters was thus secured by their insertion which permitted the speed increase.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies whch are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Joint Evidence Not Conclusive

On March 11, 1929, the Texas & New Orleans removed an F-1 New York triple valve from Trinity & Brazos Valley car 1823 and applied a K-1 Westinghouse triple valve, charging for the repairs plus C.O.T. & S. The T. & B.V. refused to accept the charge stating that nine days later the brakes on the car became inoperative and that it was necessary to scrap all of the K-1 triple valve except the body. It furnished joint evidence to the T. & N.O. to this effect and requested that the charge be confined to the triple valve body and C.O.T. & S. It contended that the triple valve applied by the T. & N. O. was scrap and unfit for service, stating that it is practically impossible to wear the parts out in nine day's service.

The T. & N.O. refused to cancel the charges as made, claiming that the charge was correct as per Item 29 of Rule 111. It stated that the triple valve was cleaned, repaired and passed over a standard 3-T triple-valve rack and that, when applied to the car and individually tested, the brakes operated properly.

In rendering its decision the Arbitration Committee stated: "Joint evidence does not prove conclusively that the check valve case was broken when triple valve was applied by the Texas & New Orleans nine days previous. Failure of this item could have occurred in fair usage subsequent to application. Car owner is responsible. Interpretation No. 2 of Rule 60 applies." *Case No. 1651--Trinity & Brazos Valley vs. Texas & New Orleans.*

Charge for Brake Beam Slide Chairs

On February 21, 1929, the Union Pacific applied two A.R.A. No. 2 plus brake beams, without third-point suspension, to St. Louis-San Francisco car 145869 in place of two A.R.A. No. 2 plus brake beams with third-point suspension (owner's defect) and issued a defect card

authorizing the correction of the wrong repairs. The wrong repairs were corrected by the S.L.-S.F. and charges made for two second-hand brake beams and two-brake-beam chairs.

The U.P. took exception to the charges for the brake beam chairs, contending that the charge and credit for the two second-hand brake beams should be authorized by Item 210-A of Rule 101 and Interpretation 23 of Rule 17, as the rules provide but one price for a second-hand No. 2 brake beam completely equipped with or without third-point suspension. The owner contended that Item 210-A of Rule 101 covers the price of a No. 2 brake beam with or without the third-point suspension feature or extension jaws in the brake-beam fulcrum, but does not include the price of the sliding chair. Although a charge was made to cover the cost of the sliding chairs applied at the time the wrong repairs were corrected, the U.P. was advised that this charge would be canceled if the sliding chairs, removed at the time the wrong repairs were made, were returned.

The decision of the Arbitration Committee in this case is as follows: "The prices for brake beams, per Rule 101, do not include the brake-beam slide chairs. The question of whether these details should have been covered by the defect card would depend on the circumstances. If they were missing or defective at time of making wrong repairs, owner would be responsible. If they were removed in good condition at time of making wrong repairs, they should have been defect carded." *Case No. 1652—St. Louis-San Francisco vs. Union Pacific.*

Responsibility for Damaged Ore Car

The B end of the Duluth & Iron Range ore car 10384 was found to be driven in and the sheets buckled while on the Northern Pacific tracks at Duluth, Minn., January 26, 1929. The owner stated that the car was of special design and that from experience it knew that the car must have been damaged while loaded, because if it had been subjected to rough usage when light it would have buckled in the center. This, the owner contended, placed the responsibility on the N. P. because the car was placed loaded on the N. P. tracks on January 19, in perfect condition and when returned empty on January 26 it was found to be in a damaged condition.

The Northern Pacific contended that the car was damaged when light by the transfer crew on January 26. It also contended that the defects were of such a nature that the owner would have been responsible for the damage even if the N. P. crew had been the cause of it because the car was inherently weak in construction. The N. P. pointed out the fact that the car was built in 1909, that it had neither longitudinal nor end sills and that in other ways it was also of weak construction. It also stated that, apparently from Question 2, following Rule 44 in the Revised 1929 Code of Rules, the attention of the Arbitration Committee had been called to cars of this type and that their ruling would make it impossible to have a Rule 44 condition on this class of car. There being no Rule 32 condition involved in the case, the N. P. contended that the owner was responsible.

In rendering a decision the Arbitration Committee stated "Car was not subjected to any of the unfair conditions of Rule 32. Owner is responsible."—*Case No. 1653—Duluth & Iron Range vs. Northern Pacific.*

Car Inspectors—Who, What and Why?*

By H. R. Rice†

WE can all remember back a few years when nearly all of the car department supervisory forces came from the car-inspection branch of the service. In those good old days some one evidently circulated a rumor to the effect that car inspectors were the cream of the car department and gradually the average car inspector, too, reached the conclusion that he, somehow, was endowed with some sort of super-intelligence which immediately becomes effective with his appointment as a car inspector.

Believing that he possessed all of this knowledge mentioned, it became necessary for the car inspector to use the knowledge, and he did; sometimes with peculiar results.

The American Railway Association issues a code of rules written as plainly as possible, which is revised from year to year and which governs the movement of cars in interchange. And what does the car inspector do, aided and abetted by his superiors, the car foremen? He takes this code of rules to a series of meetings held at more or less regular intervals throughout the year on his railroad or at his railway club or association, and he exerts himself to dig up trick questions to confuse and confound the makers of the code of rules.

Is the code of rules governing the movement of cars in interchange so complicated that so many meetings must be held and so many hours spent in discussion and argument in order to insure the safe movement of cars?

It does not seem possible that the rules are so complicated that intelligent men must attend meetings month in and month out and year after year and argue about the same old thing.

Too Many Trick Questions

Perhaps it is unfair to blame the car inspector for all of this so-called discussion. I have sat in meetings where the annual revision of the A. R. A. rules was being discussed and listened to long-winded and inconsequential arguments, not by car inspectors, but by chief interchange inspectors, general car foremen and other supervisors; and it appeared that many of the speakers had deliberately interpreted the rules for themselves and then like the Rock of Gibraltar (I should say the Sphinx but the Sphinx is too silent) stood and defied the elements to move them.

I would not want you to think that there is any intention of discouraging the attendance of the car inspectors at staff meetings of the car foremen or at the meetings of the local railway clubs. There is only one way to acquire knowledge and that is through experience and study. It is possible to acquire knowledge through the results of the experience and study of others than your own self. And such meetings provide the vehicle for the acquirement of such knowledge.

However, it is hardly profitable to anyone to attend a meeting where the time is occupied in discussion of trick questions designed primarily to fill up time and which serves no real purpose. The car foreman and other supervisors can set a good example for their subordinates by discussing questions of importance at their staff meetings as well as at the meetings of the clubs or associations, which are usually dominated by car de-

* Abstract of an address before the Indianapolis Interchange Car Inspectors Association held at Hotel Severin, February 2, 1931.

† Mr. Rice is general shop inspector of the New York, Chicago & St. Louis.

partment supervisors and especially at the clubs where the inspectors usually have little to say.

But, so long as the supervisors attend such meetings as this, and have their inspectors attend such meetings and then consume a great deal of time in insipid arguments, just so long will the car inspectors think and act along the same lines, for the attitude of the supervisors is naturally reflected in the attitude of the subordinates and as a result the code of rules fails in many instances to serve its purpose which is, primarily, to accomplish one thing to expedite the movement of traffic.

The traffic departments of all railroads are striving to obtain more business and one of the greatest aids that the mechanical department can give the traffic department is a low ratio of delay because of mechanical-department inspection. There are times, however, when the attitude of our inspection forces toward the enforcement of some real or imaginary, and usually unimportant, technicality of the rules, may delay the car and lose the business.

We are all familiar with the situation the traffic departments are combating in relation to highway trucking. Here in Indianapolis the I. C. has a car for Muncie. They deliver the car to the Belt; the Belt delivers the car to the Nickel Plate; the Nickel Plate switches the car into a train and moves it to Muncie and another engine switches the car to an industrial track. In this instance six crews of five men each have handled the car for a short haul that might have been handled by one truck with possibly two men.

Why Not Try to Expedite Traffic?

How much better it would be if the meetings were devoted to informative discussions of ways and means of expediting freight movement through terminals and inspection points—or discussions of the railroad companies' policies in connection with car repair programs. No one is in a better position to determine whether or not enforcement of the A.R.A. rules results in delays to traffic than the car inspectors. If the intent of a rule is in error there are methods by which the rule may be changed, but if traffic is lost it is mighty hard to get back again.

How much more information could the inspector get out of a meeting if the speaker discussed methods used in expediting traffic on his road and the inspector profited thereby rather than if the speaker had dug up a trick question which consumed an hour's time in discussion and meant nothing after it was finally laid aside? I imagine that it would benefit him considerably more.

Why not have some discussion by the industrial inspectors in connection with the faults or failings of the loading rules? The other inspectors see the results of improper loading and a get-together should help.

Why not discuss the lack of uniformity in the selection of cars for commodity loading? This is a fertile field for a live discussion. I dare say that it would be hard to get an agreement between any considerable number of inspectors here tonight as to just what constitutes the proper car for certain commodities. And still we must depend on commodity inspection by many men, all of whom appear to have a different idea as to just what is required for any specific commodity. A little comparison in a meeting of this nature or a foreman's staff meeting would iron that difference out.

There are many live subjects that might be discussed profitably at foremen's staff meetings and at meetings of railway clubs without devoting a considerable part of the time to technicalities. The foreman should endeavor to confine the questions to live subjects and the inspector should try to be as live as the subject under discussion.

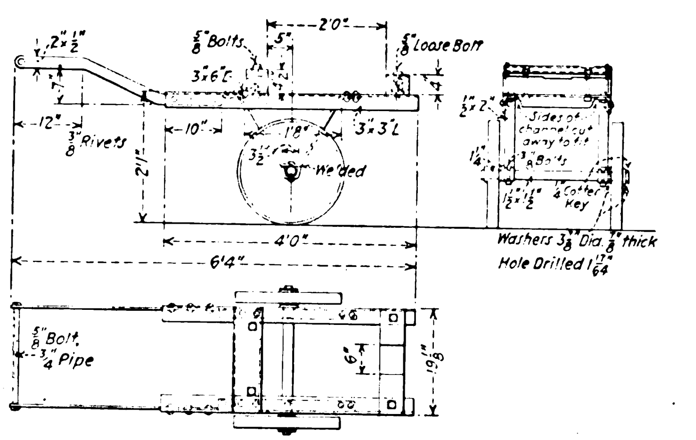
Many of the clubs or associations should take the same advice. Granting that it is sometimes difficult to secure speakers and that the subject committee sometimes has a most thankless job, it still appears that there are times when the papers presented are not exactly fitted to the occasion.

Why pick on some car department supervisor to prepare the papers, or some supply representative? I suppose that this organization, like many similar ones, complains that the car inspectors come to the meeting and do not take any part. Mr. Car Foreman, can your inspector come up to this meeting and speak his mind without hurting your feelings? Do you believe that his opinion is worthless? Try giving the inspector an opportunity to prepare a paper some evening and you may get a shock. Let him "speak out in church" as the saying goes. Perhaps you will learn something.

In the forepart of this paper I have made some remarks in connection with the car inspector's knowledge. I wonder if the car-department supervisors cannot indulge in introspection and determine wherein their own responsibility lies in connection with some of the peculiar things their car inspectors do. As the immortal poet Burns says, "O wud a power the Giftie gie us; to see oursels as ithers see us." The car department supervisors would probably see in their inspectors, reflections of all of their own idiosyncracies. And no doubt profit thereby.

Truck for Carrying Freight-Car Couplers

SHOWN in the drawing is a truck especially designed for carrying freight-car couplers. It has a height over-all of 2 ft. 5½ in. The coupler is carried on the truck with the head toward the handle. To apply a coupler and gear, the truck is pushed underneath the end of the car so that the shank of the coupler is between the draft sills. The height of the truck is such that ad-



This two-wheel truck saves labor in applying couplers to freight cars

justments to get the coupler in position require little effort. The truck is especially adopted for the standard coupler height of 34½ in. from the horizontal center line of the coupler and the top of the rail.

The chassis is carried on two cast-iron wheels 18 in. in diameter. No supporting legs or wheels to prevent tipping are required, as the truck is under a car when standing loaded.

In the

Back Shop and Enginehouse

Shop Devices Used On the C. & N. W.

MODERN shop tools and machinery are essential to the efficient operation of any railroad repair shop. Of almost equal importance are the many special tools, jigs, and labor-saving devices found in any well-organized shop. In fact, these special methods are considered by most competent observers of shop operation to afford a good index of the energy, resourcefulness, ingenuity and good judgment of the supervisory forces and shop management.

Among the many railroad shops amply provided with labor-saving devices, in almost every department, are those of the Chicago & North Western at Chicago, this being true in both the locomotive shop and the car shop. The several devices described in this article were selected at random from a great many developed in the locomotive department and which might have been mentioned.

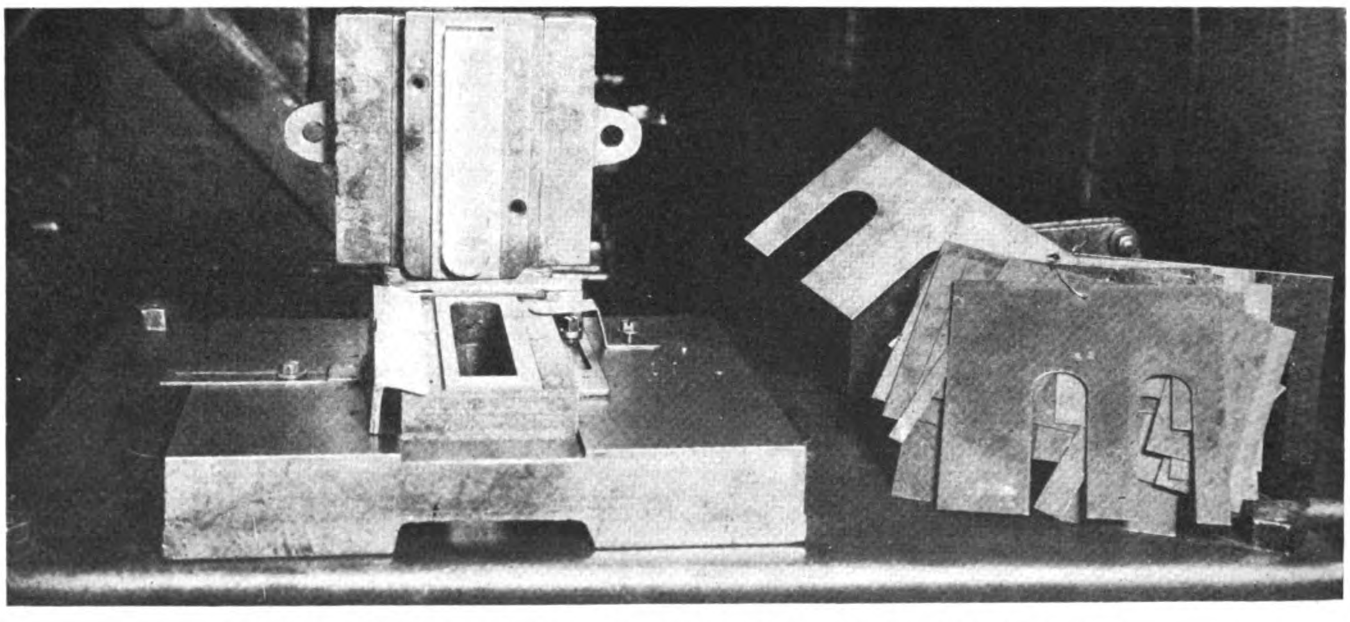
Making Guide Liners

One of the small jobs which consumes a large amount of time in the aggregate in locomotive shops is the making of guide liners, or shims, for use in lining guides, especially when erecting-shop men are permitted to cut these liners out of metal of the required thickness with a hand chisel at the bench. On the other hand, the number of liners of any one size required is usually so small that it is hard to justify the cost of making a set of dies. At least, this was the experience of the North Western, which, on investigation, discovered that a total of 47 different sizes, styles and designs of guide liners were required for locomotives coming in for repairs. Patterns of some of these liners are shown at the right in one of the illustrations, and at the left is shown a single die and punch with adjustable features by means of which any one of the guide liners can be made.

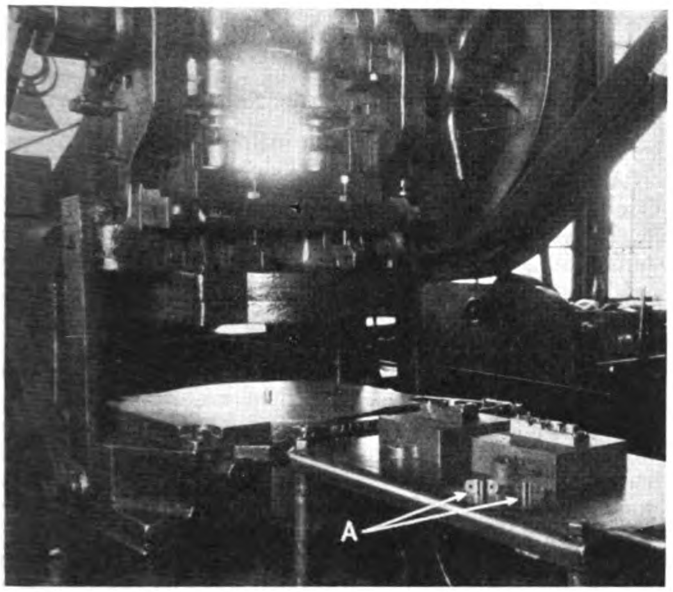
In developing this special guide liner die, the requirements were studied and a certain size of slot (1-9/16 in. wide) agreed upon as standard and suitable for all liners. A single die and a punch were then manufactured of high-carbon steel and secured in suitable recesses in the base plate and in the top header plate, respectively, by means of six screws. The base plate is recessed at the bottom to provide room for the blanks which are subsequently removed and used as number tags for various locomotive parts.

In making liners, they are blanked out to the particular size required on the squaring shears. A close examination of the illustration will show adjustable brackets which are then set to locate the slots as called for in the particular design. As many liners as desired are then run through the punch press, one slot being cut at each stroke of the press. The guiding brackets are then set to bring the second slot in the proper location and the operation is repeated. The punch itself is ground straight and the die relieved in accordance with the usual practice. The face of the die is purposely ground 1/32 in. convex, lengthwise of the slot, to give a shearing action, thus resulting in a smooth cut. A stripping plate removes the liner from the punch on the upward stroke of the press. Guide liners are made with this die and punch design out of different thicknesses of sheet iron varying from No. 24 to No. 18 gage. A production of upwards of 1,000 per 8-hr. day can be readily secured.

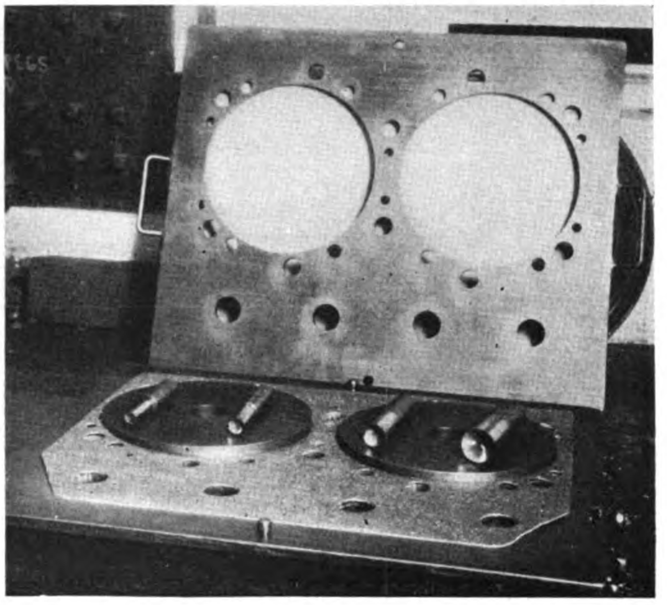
Another operation efficiently done at the Chicago



Guide liner die and punch—Templates of liners designed with standard slot width



Punch press and dies used in making clamps for copper pipes



Gasoline-engine cylinder-head gasket cutting device

shops of the North Western, on the same punch press as that used in making the guide liners, is the manufacture of small clamps used in securing copper pipe to a locomotive jacket by means of Parker-Kalon screws. These clamps, shown at *A* in one of the illustrations, are made of No. 18 gage sheet steel, being provided with a semi-circular recess to accommodate the pipe and with two holes punched to receive the screws.

The small dies used in this case are secured to the base plate and to the top header plate in the usual manner, being designed so that the two progressive operations required are performed one after the other and a clamp turned out for each stroke of the machine. Sheet steel strips of the proper gage and width are simply fed to the machine, the first stroke forming the half-round recess in the clamp and the second punching the two holes and shearing the half round ends all at one time. Each subsequent stroke of the machine, therefore, performs the first operation on one clamp and the second operation on another. A production of four to five thousand clamps in eight hours is secured.

Gasket-Cutting Device

A considerable amount of gasoline-electric rail equipment is now in operation on the Chicago & North Western and, whenever necessary, for any reason, to remove the engine heads, new gaskets are usually applied. These gaskets, made of a composition material, were formerly purchased new from the manufacturer, but are now made at Chicago shops. Inasmuch as the relatively small number of gaskets used prohibited the making of expensive dies for the operation, the comparatively simple gasket-cutting device, illustrated, was devised, which permits the railroad to make its own gaskets with a total saving, including labor and material, of 75 per cent.

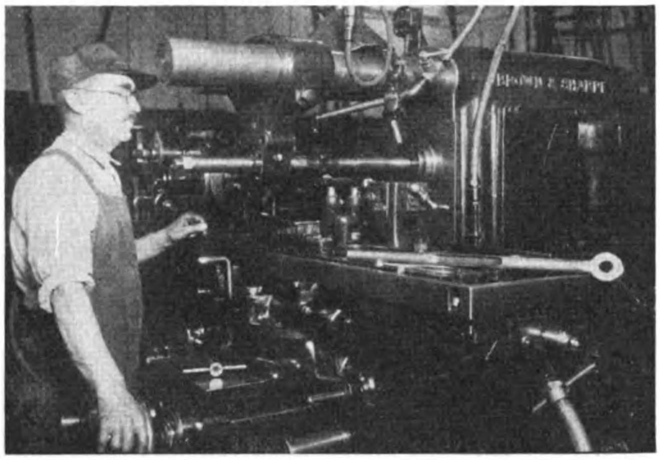
The device consists of two ¾-in. steel plates, planed down to a true surface on one side of each plate only, and provided with two locating pins and corresponding holes so that when the upper plate is placed on the lower it always takes exactly the same relative position. For convenience, the upper plate is provided with two handles to be used in removing or applying it. Both of these plates are laid out and drilled for the various port and bolt holes required. Two large holes in the upper plate, corresponding to the cylinder bores, are an accurate sliding fit on the two flat cylindrical pieces pressed into the cylinder bore holes in the bottom plate of the device. Four punches, of the various sizes required, are made to be an accurate sliding fit in the small holes and are ground concave on the ends, as illustrated.

The first operation in making the gaskets is to cut the material or packing to the proper size on squaring shears in the tin shop. A templet is then applied to locate the cylinder centers, a trepanning tool being used to cut out circular sections of the packing corresponding to the cylinder bores. The gaskets are then placed over the cylindrical projections corresponding to the cylinder bores in the bottom plate, and the top plate is lowered in place, being positioned accurately by the locating pins and cylinder bore holes mentioned. The weight of the upper plate holds the packing in place while the small punches are being used to cut out necessary holes in the packing. One blow on the punch with a wooden mallet is sufficient to make a clean, accurately located hole. After all of the holes have been punched, the top plate is removed and the gasket is found to be smoothly and accurately cut. The production is about 75 gaskets in eight hours. Gasket-cutting plates of this type have been developed for the various sizes of gasoline engines now used on the North Western and, owing to the simplicity of the device, only a relatively small investment is involved.

Globe Valve Tester

The modern locomotive requires for its successful operation an increasing number of valves of different types, perhaps the simplest of which is the ordinary globe valve. These valves must, to a greater extent than ever before, stand high pressures, operate easily and be tight. To assure the existence of these qualifications, all valves on general repair locomotives at the Chicago shops of the North Western are taken to the brass room on the balcony, thoroughly overhauled and tested in the device illustrated. This is simply a quick and convenient means of putting a water test on the valves without the labor of screwing them onto the test line.

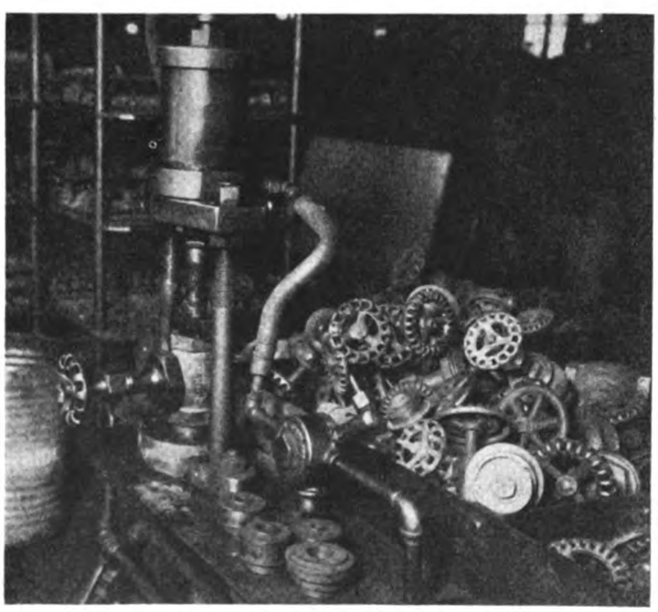
The device is mounted on a bench adjacent to the



Modern Universal tool-room miller machining a keyway or groove in a signal equipment part

steel compartments where valves awaiting repairs and those overhauled are located. The device comprises a base plate through which the shop air pipe passes and on which the valve rests, being held in place by a cross bar attached to the plunger of a small air cylinder. The latter is supported, as shown, on two 1-in. studs threaded into the base plate of the device. A three-way valve, with suitable handle, provides for the supply and exhaust of air to and from the cylinder. False seats, provided with leather gaskets, are available for use with valves of different sizes.

In operation, therefore, a false seat of the required size is placed in the testing machine and the valve held on this false seat, while the air pressure is applied and the plunger comes down to hold the valve firmly against the 90 or 100 lb. usually carried in the shop air line. The cavity in the upper part of the valve is then filled with water and air pressure applied from the underside, any leak in the valve being immediately apparent by the passage of air through the water. The simplicity of this device gives no measure of its effectiveness, as will be appreciated by anyone who has ever tried to test valves by screwing them on to a test line, or possibly permitting defective valves to go back to the locomotive, give trouble and have to be removed for repairs after being applied.



Simple device which saves labor in testing globe valves

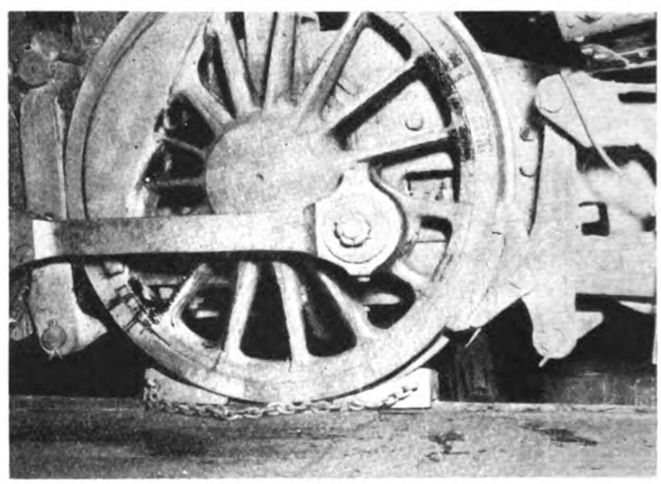
A similar device, with only slight necessary modifications, has been developed for the testing of angle valves.

Tool-room Miller

A machine which is giving a very good account of itself in the tool-room of the Chicago shops of the C. & N. W. is the Brown & Sharpe No. 3A universal miller, illustrated. This illustration shows the machine being used in conjunction with a B. & S. dividing head for machining the odd-shaped keyway, or groove, in a lock plunger forming part of the signal equipment. This use simply serves to indicate the wide variety of operations which a railroad tool-room miller is sometimes called upon to perform, and for which the universal miller is well adapted. This milling machine is notable for rigidity, accuracy and ease of operation, quick return of the table and the work being provided in all directions. The machine is used mostly for the manufacture of special helical milling tools, and taps, which cannot be bought in the open market. Special seating tools for line check valves, angle valves, injectors, etc., are also made on this machine, as well as forming and blanking dies, and all jig work requiring accuracy. High-speed steel cutters are employed so that the operations can be carried out with a minimum loss of time, and the machine is designed to stand the cutting feeds and speeds encountered in this type of operation.

Forged Steel Chock Blocks

IN the illustration is shown an effective set of chock blocks for use as a safety measure under the wheels of locomotives standing under steam. They are



Chock blocks of forged steel with faces machined to fit the contour of driving tires can be used effectively to hold locomotives standing under steam

12 in. long, 5¾ in. wide and 5½ in. high at the heel and, thus, are higher and thicker than the ordinary wooden wedge used for this purpose. After the forging is made, the face of the block is machined to a radius of 26 in. and to fit the contour of the tread of the driving-wheel tire with a recess for the flange. The bottom of the block is slotted to a width of 3½ in. to fit over the top of the rail. Two ½-in. tool-steel pins

are pressed into the face of the slot near the heel of the block, with only the points projecting, thus increasing the friction between the block and the rail should the driving wheel run up on the block. A 15/16-in. hole is drilled through the block at its thickest point for the insertion of a 7/8-in. eye-bolt. Two blocks are joined together by a short length of chain which is attached to the blocks by means of the eye-bolts.

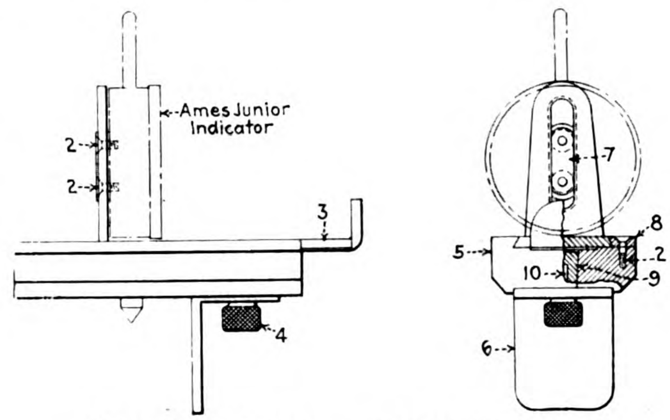
During a test which was made to determine the effectiveness of the blocks, the wheels of a locomotive failed to mount them, the drivers spinning on the rail which resulted in moving the blocks a distance of 2 in. The driving wheels, rolling on the radial faces of the blocks, imbeded the small tool-steel pins in the face of the rail, thus preventing the blocks from slipping.

Bushing Fixture For Ames Indicator

THE fixture or mounting, the assembly and details of which are shown in the two drawings, is used in connection with the Ames Junior indicator, manufactured by B. C. Ames & Company, Waltham, Mass. It is used in the air-brake repair department and tool rooms of an eastern railroad primarily for checking bushings. It is standard practice in the air-brake department on this road to true bushings that vary in excess of .001 in.

The numbered parts on the detail drawing refer to the numbers shown on the assembly drawing. The indicator is secured to the vertical arm of the indicator slide (3) by means of the screws (2) and the block (7). A slot in the indicator slide permits adjusting for height. The indicator slide is machined to fit the grooves in the top of the base (5), and is held in place by the gib (8), which is secured to the base by three machine screws, countersunk as shown. The bracket (6) is machined to slide in the groove on the bottom of the base (5) for purposes of adjustment. The thumb screw (4) screws in the taper block (9), which can be moved to any position desired in the slot in the center of the base (5). Two dowel pins (10), machined for a loose fit in the two 1/8-in. holes in the block (9) are riveted to the top horizontal arm of the bracket (6).

The contact point of the indicator should extend below the base as shown on the assembly drawing. Work to



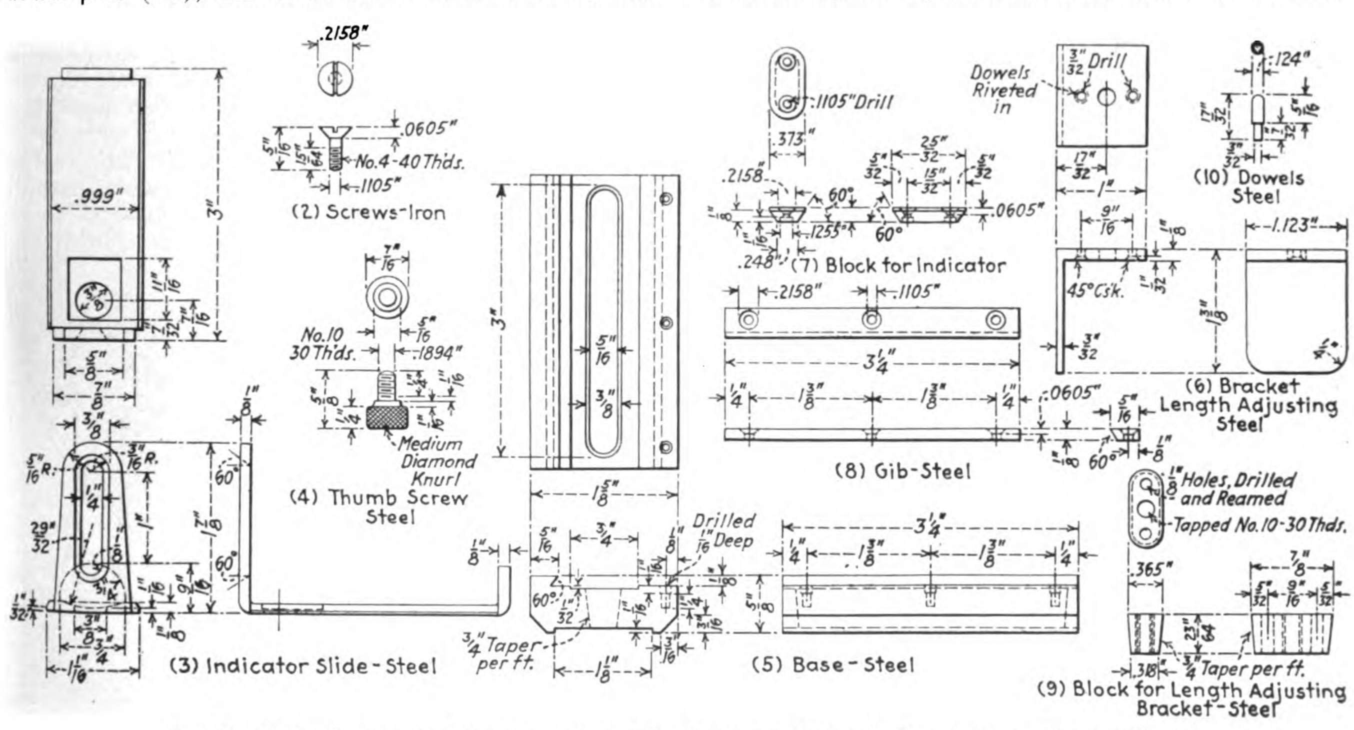
Ames Junior indicator applied to the fixture

be checked is placed on a flat-finished surface plate in the usual manner, using the vertical leg of the bracket as a rest for the fixture.

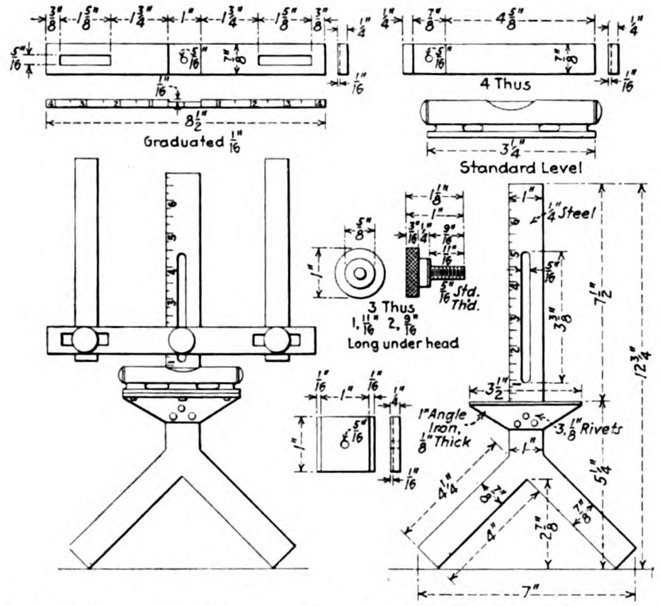
Gage for Setting Up Crossheads

THERE are a number of methods in common use for setting and alining the top crosshead guide after the bottom one has been bolted in position. One method in practice on an eastern road makes use of the common gage shown in the drawing.

The gage consists of a base, the legs of which are set at an angle of 90 deg., a section of 1-in. angle iron, a standard 3-in. level and a graduated scale, all riveted together to form an integral piece. A cross bar, graduated in sixteenths of an inch, is attached to the graduated scale by an 11/16-in., knurled-head bolt which is



Details of the fixture used in connection with the Ames Junior indicator for truing bushings



A leveling gage for adjusting the top guide when setting up crossheads

used to adjust the cross bar vertically in a 3⅜-in. slot cut in the scale. Two vertical pieces of ⅞-in. by 1/16-in. sheet steel are fitted in small slots at each end of the cross member by means of 9/16-in. knurled-head bolts.

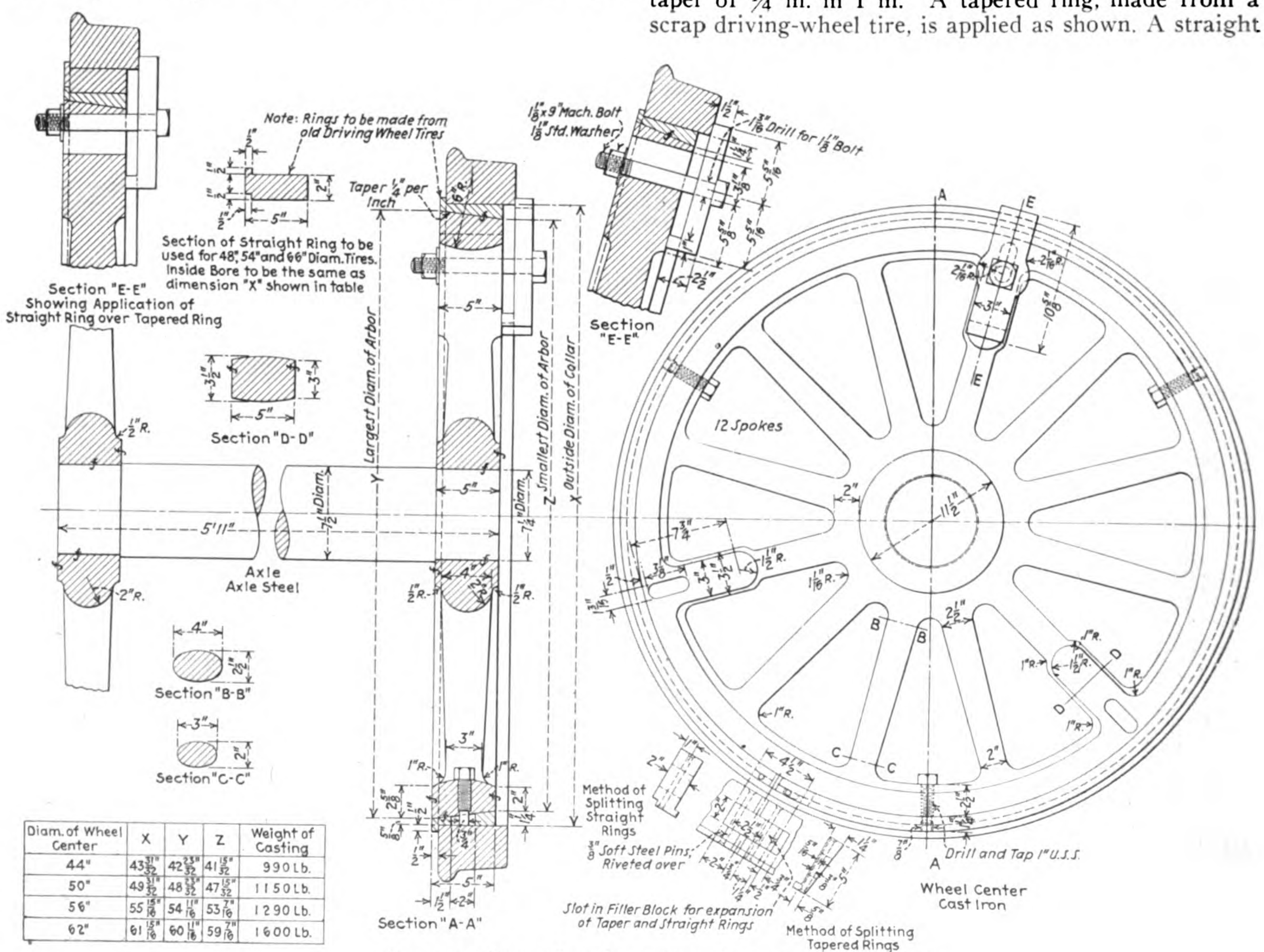
When in use, the vertical members are adjusted horizontally so that the distance between their inside edges is the width of the face of the guide. The cross member is then adjusted vertically after the crosshead has been calipered to determine the distance between the guides.

When the top guide is temporarily applied, a small scale can be set face to face with the vertical graduated scale of the gage to determine what thickness of liner is necessary under the guide to give the crosshead the proper clearance after it has been set up.

When the liners are made and applied, the gage is placed on the bottom guide, which has been set and alined by the usual method of centering a string in the cylinder and extending it back past the guide yoke. As the gage is set at various places on the lower guide and leveled, the top guide is brought into a position which will bring its face between the vertical members of the gage. When the face of the top guide sets between the vertical members of the gage, requiring no further adjustment, temporary bolts are applied, preparatory to reaming the holes for the application of the guide bolts.

Expanding Arbor for Turning Tires

THE expanding arbor shown in the drawing is designed for turning unmounted tires on a wheel lathe. The wheel center is of cast iron and has 12 spokes, three of which are cast and cored as shown at sections *D-D* and *E-E* for 1⅛-in. by 9-in. clamping bolts. The rim of the wheel center is machined with a taper of ¼ in. in 1 in. A tapered ring, made from a scrap driving-wheel tire, is applied as shown. A straight



Diam. of Wheel Center	X	Y	Z	Weight of Casting
44"	$43\frac{31}{32}$"	$42\frac{23}{32}$"	$41\frac{15}{32}$"	990 Lb.
50"	$49\frac{31}{32}$"	$48\frac{23}{32}$"	$47\frac{15}{32}$"	1150 Lb.
56"	$55\frac{15}{16}$"	$54\frac{11}{16}$"	$53\frac{7}{16}$"	1290 Lb.
62"	$61\frac{15}{16}$"	$60\frac{11}{16}$"	$59\frac{7}{16}$"	1600 Lb.

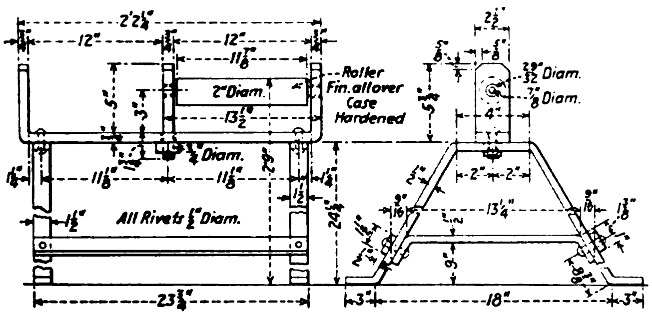
An expanding arbor for truing tires on a wheel lathe

ring can also be used when the inside diameter of the tires require additional diameter for the arbor. Both the tapered and straight arbor rings are split, and a slotted filler block is provided to allow for expansion of the rings. Three 1-in. bolts, turned down to 7/8-in. diameter 1 1/4 in. from the end, are spaced equidistant around the wheel center to prevent the rings from slipping off. Two-inch holes in the rings allow sufficient free movement of the rings to facilitate the application and clamping of the tires in position.

Tightening the nuts on the three clamping bolts causes the tapered ring to expand around the wheel center and thus clamp the tire in position for turning.

Feed Stands for Use with Power Shears

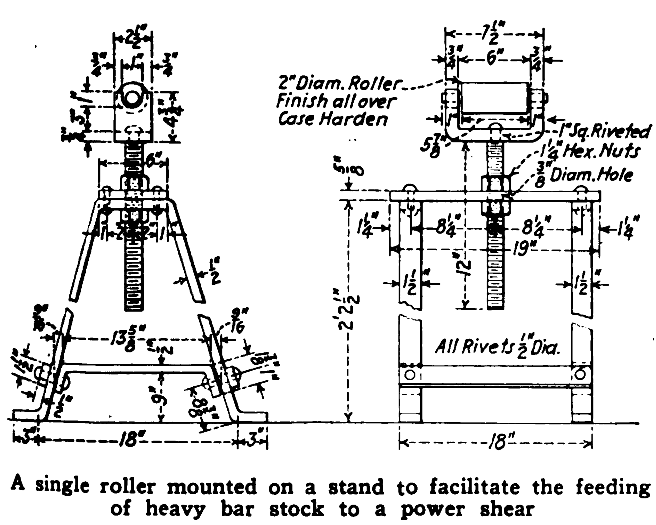
IN the two drawings are shown feed stands which are designed to facilitate the feeding of large and small bars of iron and steel to sheers during production cutting operations. One of the stands consists simply of a 2-in. roller inserted in a yoke, riveted to one end of a 1 1/4-in. by 12-in. threaded bar which is supported on the stand by two jam nuts. The nuts may be loosened and the



A roller-feed stand designed with a rack which expedites the production cutting of small bar stock

bar raised or lowered to any desired elevation; after which they are tightened against the stand, rigidly holding the roller in its set position. The stand supporting the roller is 18 in. wide, 19 in. long and 27 1/8 in. high. The legs and braces are constructed of 1/2-in. by 1 1/2-in. slab iron, while the top, through which the threaded bar extends, is made of 5/8-in. by 6-in. plate.

The other stand is a combined feed stand and rack



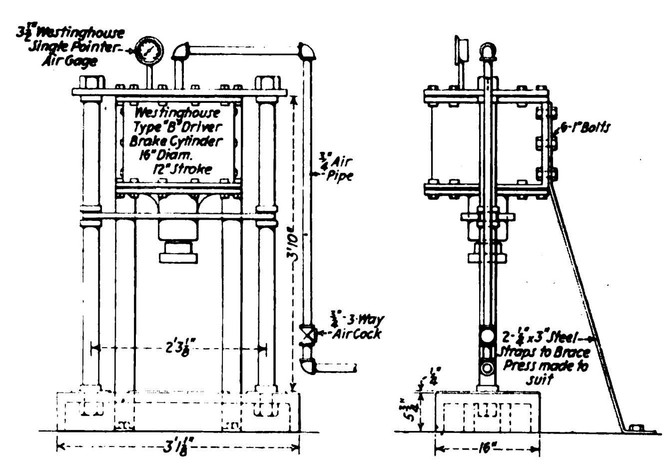
A single roller mounted on a stand to facilitate the feeding of heavy bar stock to a power shear

and is designed primarily for feeding small bar stock to the shears. There is no provision made for elevating or lowering the roller of this stand which is 2 ft. 9 in. above the floor. The stand is made of sufficient strength to permit the storing of a quantity of stock beside the roller, one end of the plate forming the top of the stand being flanged up to prevent the bars from rolling off. The stand is constructed of 1/2-in. by 1 1/2-in. slab iron and is 18 in. wide and 23 3/4 in. long.

Pneumatic Press for Valve-Motion Bushings

IN shops where considerable rod work is done for locomotives in adjacent enginehouses in addition to the regularly scheduled back-shop work, hydraulic bushing presses are often worked at maximum capacity. This, in many instances, is detrimental to the progress of smaller work through the shop such as the pressing of bushings in various valve-motion parts. Again, it is not always desirable to operate a large hydraulic press for such light work.

The pneumatic press shown in the drawing is especially adaptable for light work. The press, which is 3 ft. 10 in, high and set on a 3-ft. 1 1/8-in. by 16-in. by 5 3/4-in. cast-steel base is designed to be mounted on a work bench and consists of a Westinghouse 16-in. by 12-in. driver-brake cylinder mounted between and near the tops of two 2 1/2-in. by 4-ft. 5-in. round steel rods. The rods are threaded top and bottom, at the top for the application of a horizontal cross brace and at the bottom for bolting them to the cast steel base. A second horizontal cross brace is placed below the cylinder while



A pneumatic press for small bushing work which can be mounted on a work bench

two 1/4-in. by 3-in. steel straps are bolted to it and to the work bench for supporting the assembled press. In view of the fact that the press is mounted on a work bench the air-operating valve is situated in a position near its base.

FIFTY YEARS AGO.—Freight business on most western railways is now immense, and every wheel is needed to dispose of the rush of agricultural products and merchandise. Lack of cars and locomotives represents the greatest complaint. The shops are crowded with orders for new equipment, some roads are leasing locomotives and cars from others, passenger engines are pressed into freight service, and practically all machinery is compelled to do double duty.—Railway Age, August 5, 1880.

NEW DEVICES

Water Conditioner Tests

THE Locomotive Water Conditioner, developed jointly by the Bird-Archer Company and the Chicago, Milwaukee, St. Paul & Pacific, under the direction of R. W. Anderson, general superintendent of motive power, was first applied to the Mikado-type locomotive, illustrated, about two years ago. From a descriptive article, published on page 165 of the March 1930 issue of the *Railway Mechanical Engineer*, it will be recalled that the principal objectives sought in the development of the device were simplicity, relatively low cost, low maintenance, feedwater heating, storage of hot water, feedwater treatment and removal of oxygen. It is too early yet to say to what extent all of these objectives will be attained under all conditions of service. The first three are more or less inherent in the design. There is no question about the hot water storage feature, and tests indicate that an average feedwater temperature of 208.6 deg. F. is readily attainable, as well as an average oxygen elimination in excess of 82.4 per cent. The success of service tests of the device on the Milwaukee to date are such that, besides the two light and heavy Mikados already equipped, five additional installations are now being made, including one on a converted 2-6-6-2 type locomotive.

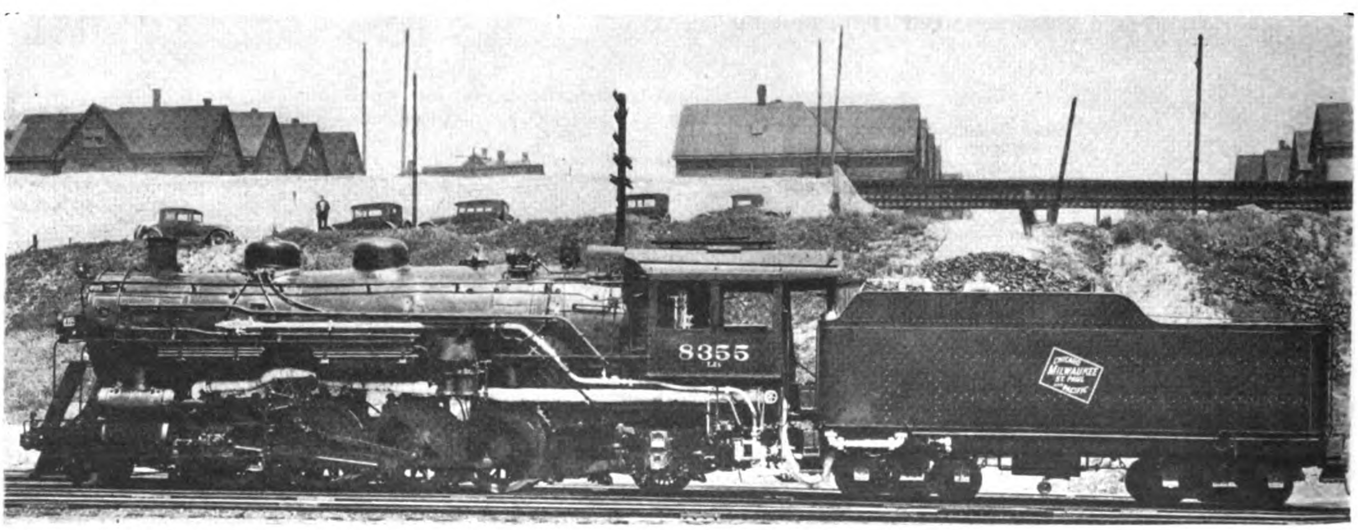
A number of important improvements have been made since the Locomotive Water Conditioner was first described in the *Railway Mechanical Engineer*, the principal ones being the application of an exhaust steam ejector to replace the small turbine-driven pump for supplying cold water from the main tank to the hot water storage compartment; and the development of an improved, turbine-driven, feedwater pump unit which will take hot water and deliver it efficiently and reliably against high boiler pressures. This pump was described on page 719 of the December issue of the *Railway Mechanical Engineer.*

The general principle of operation of the Conditioner has not been changed. Exhaust steam is brought back from the cylinders through a 6-in. pipe to heat the water in one leg of the tank which has been partitioned off to form a hot-water storage compartment of 700 gal. capacity, or more, dependent upon the needs. The temperature of water in this compartment is held uniformly at or near the boiling point, as long as exhaust steam is available, by means of a thermostatically-operated exhaust-steam control valve. A fixed water level is maintained in this compartment, as long as the locomotive is in operation, by means of a float which operates through a Crane butterfly valve to control the supply of steam to the ejector. When the locomotive drifts or stops, this supply of stored hot water may be drawn upon to feed the boiler through the boiler feed pump. The design is thus adapted to assure the full benefits of feedwater heating, not only to road locomotives, but to yard, switch, transfer and other locomotives in intermittent service.

Feedwater Temperature Maintained in Excess of 140 Deg. F.

An ingenious and effective device is provided to prevent the possibility of injecting cold water into the boiler at any time, whether the locomotive is working or not. Should any attempt be made to start the boiler feed pump when water in the storage compartment is at less than 140 deg. F., high-pressure steam is admitted to the water at the pump suction under the control of a thermostatically-operated live-steam valve. Just as soon as exhaust steam is available to heat the water in the compartment above 140 deg., the live-steam valve automatically closes.

As a result of the above provision in the design of the Conditioner equipment, its operation has been rendered as nearly automatic as possible, boiler feeding being reduced to its simplest form, or, in other words, a one-valve operation, with the equipment available for use at all times. The boiler feed pump steam valve in the cab is the only one requiring the attention of the engine crews, all other valves in the equipment being entirely automatic in action and of rugged construction, designed to give reliable service over a long period, under exacting conditions. The thermostatic control, required on only two of the valves, consists of a thoroughly-tested



C. M. St. P. & P. locomotive on which the Water Conditioner was tested

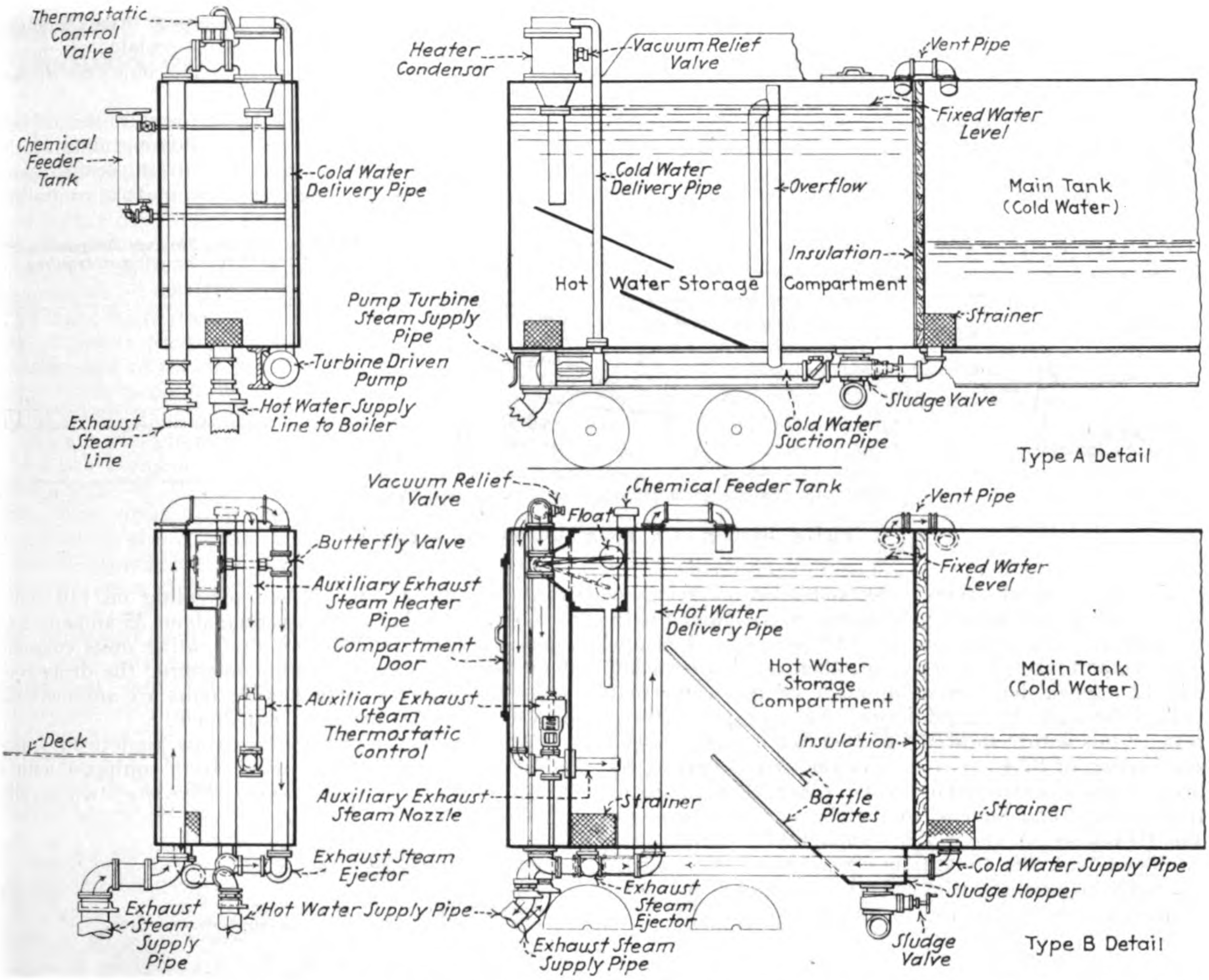
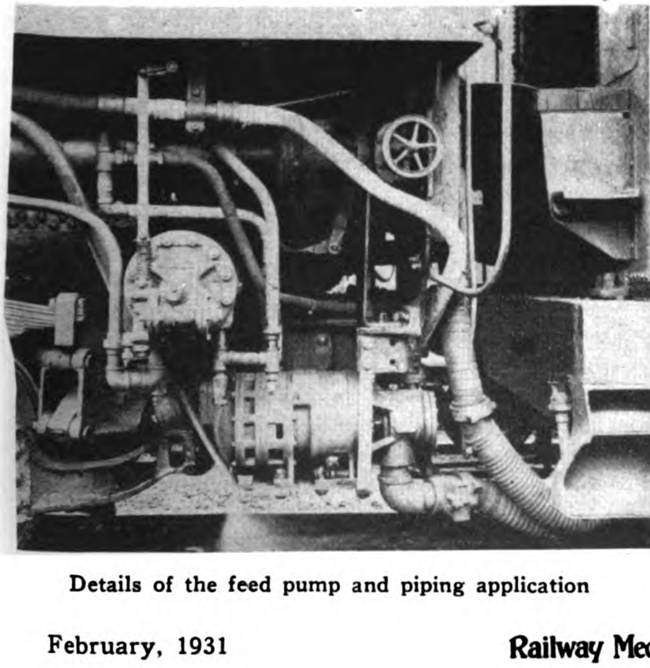


Diagram showing construction of the Type A and the Type B Conditioners as applied to the left water leg of a tender tank

design, especially adapted for use with this equipment by the Fulton Company, Knoxville, Tenn.

Chemical treatment of the water is secured by the insertion of briquettes of the necessary chemical composition in a cylindrical container with removable cap, located on the left water leg of the tank, and connected to the cold-water delivery pipe, as illustrated in the drawing. Cold water, carrying the proper amount of the required chemical solution, then passes to the cold-water delivery line, mixes with exhaust steam in the heater condenser and is delivered to the hot water storage compartment where the chemical reaction is greatly speeded up, owing to the high temperature. Any scale-forming impurities or free mud which settles in the bottom of the compartment can be readily discharged at terminals through the sludge valve, illustrated.



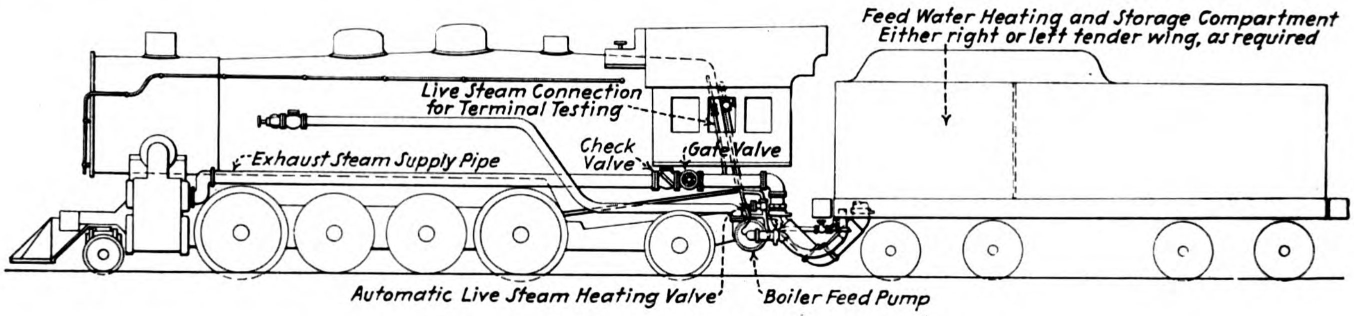
Details of the feed pump and piping application

Two Types of Water Conditioners

Referring to the diagram, it will be noted that the Locomotive Water Conditioner is now available in two types, Type A employing a turbine-driven pump for supplying cold water to the storage compartment, and the Type B employing an exhaust steam ejector for this purpose. In the latter case, cold water flows by gravity to the ejector, where exhaust steam, drawn from the main cylinders, combines with the water and forces it through the hot water delivery pipe to the storage compartment. The heating of the water in the Type B Conditioner is thus accomplished in two stages; first, in the ejector, and, second, by the admission of exhaust steam through the thermostatic control valve directly

in the hot water storage compartment. The ejector is wholly automatic in operation.

Throughout the development period of the Locomotive Water Conditioner on the Milwaukee, the temperature of the water entering the boiler has been closely observed on numerous tests. In addition, test records of temperature and oxygen removal have been made by Dr. D. H. Koyl, water service engineer of the railroad. Doctor Koyl's report shows that on one test run an average temperature of 208.6 deg. was obtained with an average oxygen removal of 89.8 per cent. Twenty-four temperature readings were taken on this occasion and 12 oxygen determinations made of the water that passed through the Conditioner. An average of three tests of this nature showed, however, an average oxygen elimination of 82.4 per cent. The device has been operated without extra labor costs, other than ordinary maintenance, and the cost of the chemicals required for the treatment of the water evaporated. Locomotives equipped with the Conditioner have been successfully operated in territory where both treated and untreated waters, as well as mixtures of the two are handled.



Piping diagram of a Water Conditioner application

Pease Junior Model Print Dryer

THE Pease Junior Sheet Dryer, manufactured by The C. F. Pease Company, 813 North Franklin street, Chicago, is designed for the drying of moderate sized blue-prints, negatives, blue-line and brown-line prints up to 24 in. wide. Also, when a chromium-plated cylinder is used, it is particularly adapted for drying photo prints. The Junior Model Dryer closely resembles the larger size Pease dryers in design.

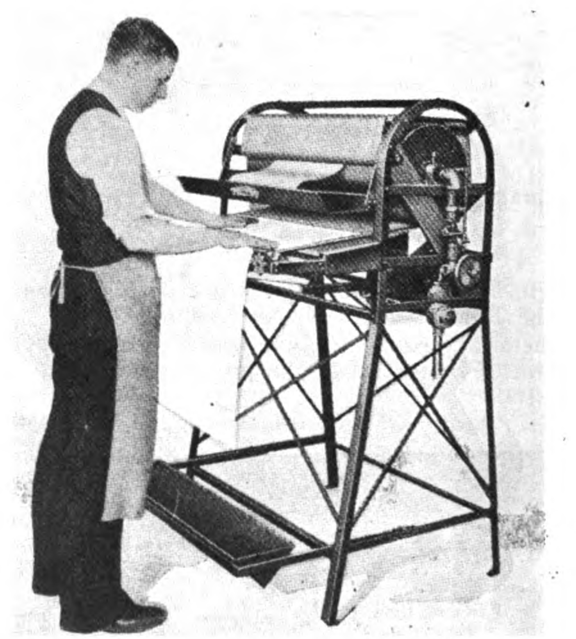
Prints are fed into the dryer over a brass scraper rod and up an inclined feed table which drains the water away from the drying drum and prevents steam pockets and creased prints. Beneath the feed table is located an adjustable drip pan where all surplus water is collected. This pan can be raised or lowered as required for handling either long or short prints. After drying, prints are automatically returned into an adjustable tray at the front of the machine which can be pushed back out of the way when exceptionally long prints are being run.

The revolving copper drying drum can be furnished with either gas or electric heating elements; also, it can be had chromium plated when so specified. Chromium plating is recommended for use in connection with drying photo prints as the drum can be easily cleaned with a damp cloth and will not be affected by chemicals.

When equipped with a gas heater, the revolving copper drying drum contains one burner and can be heated to proper drying temperature in about three minutes. The dryer is equipped with a hand-regulated air-mixer valve and consumes approximately 20 cubic feet of gas per hour.

When equipped with an electric heater, the drying drum contains two Nichrome wire heating units which are capable of heating it to proper drying temperature in about 10 minutes. Each of these units is controlled by a separate switch. When operating on 110 volts, the electric heating units consume about 35 amperes and when operating on 220 volts the heating units consume about 20 amperes. The motor operating the drum consumes 1½ amperes. The heating units are automatically cut off when the motor is shut down.

The dryer is constructed with an angle-iron frame finished in olive-green enamel. It is equipped with a ⅛-hp. motor and variable gear drive for two speeds, either two or three feet per minute. At the front and right-hand side of the machine is a hand-screw regulator for controlling the canvas band. All parts of the machine are accessible and can be easily cleaned and oiled.


The Pease Junior-model sheet dryer

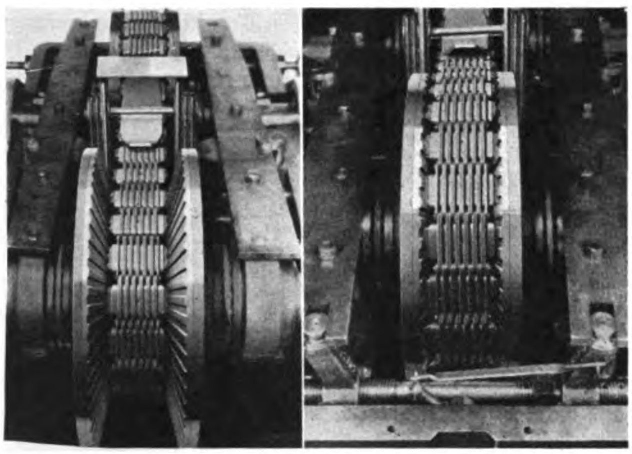
The overall height of the Junior dryer is 5 ft. 3 in. and the floor space it occupies is 3 ft. 5 in. wide by 3 ft. 6 in. deep. The complete machine is shipped fully assembled ready for connection and immediate operation.

Link-Belt Variable Speed Transmission

THE variable speed transmission shown in the illustrations consists basically of two pairs of wheels of the opposed conical-disc type, between which a unique chain transmits power. The effective diameters of each pair of wheels can be altered under load to change the speed ratio, without steps and without dependence on friction. On changing speed, the self-pitching chain rises in one set of wheels and descends in the other, so that while the input shaft connected to a motor or other source of power turns at constant speed, the output shaft is brought to the desired revolutions per minute.

The variable-speed device is designated as the P. I. V. Gear, the initials standing for "Positive Infinitely Variable," indicating its characteristics, and is the product of the Link-Belt Company, Philadelphia, Pa. The wholly original feature of the P. I. V. Gear is its use of a positive chain drive to transmit the power. Radial teeth are cut in the conical faces of the driving discs, and the self-adjustable teeth projecting beyond the sides of the chain are arranged to engage the radial teeth of the discs.

The chain used in the P. I. V. Gear is made up of a series of steel leaves or links with joints consisting of hardened-steel pins turning in segmental bushings. There are no teeth on the inner surface of this chain. Instead, what may be called teeth are made up of packs of hardened steel laminations or slats which extend through slots in the links at right angles to them, and project about 1/8 in. at each side of the chain. The individual containers which hold the packs of slats are secured in the openings of the links but, within each such container, the slats are free to slide from side to side individually with relation to each other and adjust themselves to engagement with the radial teeth of the discs over substantially the full range of diameters. The angle of the slat ends is 30 deg., the same as that of the conical faces of the wheels.



The tooth formation of the P.I.V. chain on the minimum (left) and the maximum (right) diameter of wheel

The teeth of the discs widen from the center outward toward the circumference, but are of uniform depth. They are staggered relatively on each pair of wheels so that the slats move back and forth into the teeth to mesh correctly as the chain comes into contact with the wheels. Self-pitching of the chain to any tooth width or wheel diameter is thus assured. At each engagement of the chain and wheels, the slats are regrouped within their separate containers, but do not slide nor move under working pull. Their movement in engaging with the wheels is complete before the load is applied.

All the elements of the P. I. V. Gear are built into and protected by an oil-tight housing, and are automatically splash lubricated. The hardened steel wheel faces are mounted on cast-iron hubs backed by ball thrust bearings, and move axially on the shafts, which in turn are mounted in radial ball bearings. The movement of the pairs of wheels together or apart, in order to increase or decrease their effective pitch diameters, is controlled by a pair of pivoted levers operated through a hand control shaft with right-and-left-hand screw motion. Initial chain tension is provided for by an external adjustment screw by two hardened shoes which ride lightly on both upper and lower strands of the chain, under constant spring pressure. A speed indicator permits a ready check-up on operating speed settings.

The unit has been put to production by the Link-Belt Company for the present in five sizes, from 1 to 10 hp. capacity, providing speed change ratios up to a maximum of six to one. It has been tested throughout the past year by continuous operation in driving machine tools, textile equipment, baking, glass- and paper-making machinery.

Dulux—A Synthetic Paint Vehicle

A NEW vehicle for use with interior, and exterior, finishing materials and a group of paints and enamels utilizing it, has been developed by E. I. du Pont de Nemours & Co., Incorporated, Wilmington, Del. Designated as Dulux, the vehicle is used in two forms: Dulux gum serving as a vehicle for enamels and Dulux oil serving as a vehicle for paints. The Dulux vehicles are made by chemical reactions which require extremely close chemical control and which, when completed, have none of the properties commonly associated with the usual resins, gums and oils used in paint manufacture. They are distinct chemical compounds, their properties depending as much upon the method of manufacture and upon control during manufacture as they do upon the ingredients used.

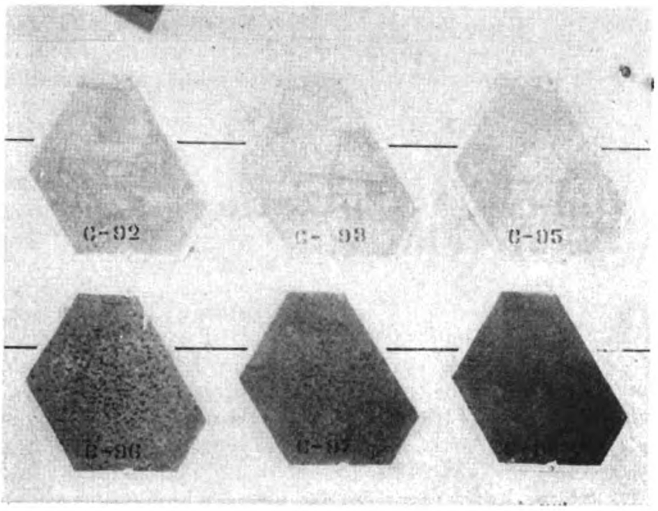
In the Dulux products using these vehicles for interior and exterior enameling, Dulux gum is used to bind the pigment together. This is a rubbery material which hardens to the toughness of horn and is said to have remarkable durability and retention of elasticity. It is dissolved in special solvents to form the Dulux vehicle and in no way is associated with the common practice in making paint vehicles by dissolving resin, fossil gum or brittle synthetic resins in oil by the application of heat. Enamel finishes using this gum as a vehicle are designed for use on machinery, furniture, signs, busses, railway equipment, etc., where a quick-drying, hard, enamel-like finish is desired. In Dulux finishes for exterior and interior painting, an oil-like vehicle is used which gives softer but more durable films than the gum-like vehicle used for enameling. This oil, like Dulux gum, is a synthetic product and has no relationship to the material ordinarily used at present in the paint trade. Finishes from this oil are used in the places where linseed oil or chinawood oil paints are now commonly used, as, for example, on building exteriors, bridge and steel work, etc.

To determine the relative durable qualities of Dulux

oil and linseed oil, comparative tests were made with ordinary vehicles and with the Dulux vehicles by the du Pont Company. Ordinary white-pine clapboard panels were coated, in one case with linseed oil, in another case with heat-bodied linseed oil and in a third case with Dulux oil and placed on exposure racks at an angle of 45 deg., facing south. In six months, according to the records of the du Pont Company, the linseed oils had disintegrated to such an extent that they no longer protected the wood and the panels were badly warped. At the end of two years the panel coated with Dulux oil was still in perfect condition. Numerous other comparative tests were made, all of which are said to have indicated the superior durable qualities of the Dulux vehicles.

Dulux for Interior and Exterior Painting

To test further the Dulux oil vehicle used for interior and exterior painting, equal quantities of a pigment of maximum chalking or fading tendency were placed in a Dulux oil vehicle and in a linseed oil vehicle. The panels painted with these products were exposed side by side on the same exposure fence at 45 deg. The du Pont records reveal that the linseed-oil paint chalked through to the wood in less than eighteen months while the Dulux oil product was still in perfect condition at the end of that period. The same test was made on panels painted with a pigment of maximum cracking tendency. At the end of eighteen months the linseed-oil paint cracked and flaked through to the wood while the Dulux paint was still giving complete protection to the wood. Similar tests were made comparing Dulux products for exterior painting with ordinary white lead, linseed-oil white exterior paints and with various colored paints with linseed oil vehicles. Invariably, it is said, the Dulux paints withstood longer than the others any tendency to fade, chalk or whiten.



.0028 in.	.0040 in.	.0062 in.
.0027 in.	.0043 in.	.0076 in.

Top row—Different thicknesses of Dulux oil on polished metal. Bottom row—Similar thicknesses of linseed oil on polished metal. All panels exposed 100 days on a 45 deg. fence at Wilmington, Del. to compare the corrosion of the two vehicles

Metal Protection

For the protection of metal, the high resistance qualities of Dulux products were also established to the satisfaction of the du Pont Company by comparative tests, similar to the ones mentioned above, with paints of linseed oil base. In addition, tests were completed to determine the permeability of Dulux to moisture.

From this test, the results of which are shown in the chart, Dulux oil, both clear and pigmented, was found to be approximately three times as impermeable as linseed oil and approximately twice as impermeable as ordinary metal-protective vehicles containing blends of linseed oil, chinawood oil and spar varnish.

Under ordinary conditions Dulux finishes for exterior and interior painting are dust free in three to six hours, and dry enough for recoating in from eight to eighteen hours. They atomize freely and are therefore suitable for spray application but still have enough body to adhere to vertical surfaces without sagging, breaking or running.

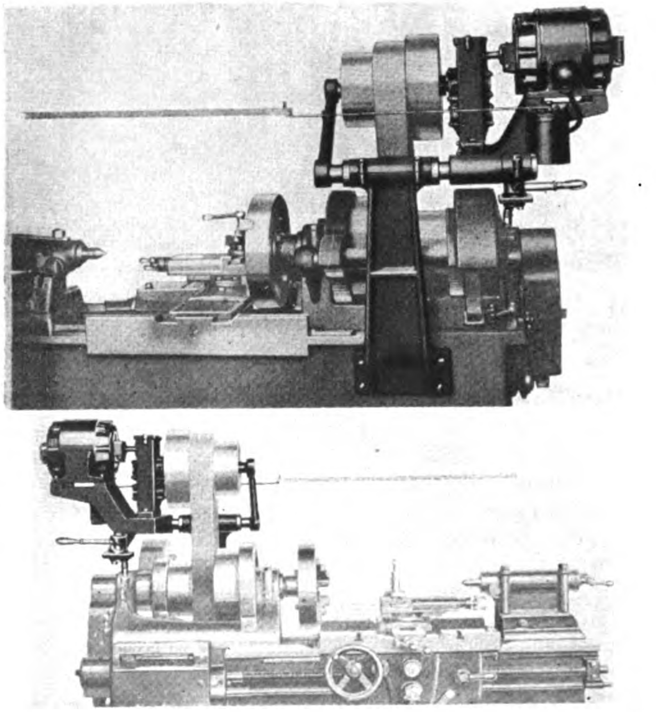
Dulux for Exterior and Interior Enameling

Dulux products for enameling are flexible when first applied and retain their flexibility over a long period of time. They are also resistant to chipping or cracking.

The enamels dry quickly, being dust free in approximately twenty minutes and may be recoated within one hour after the first application. The film is tack free in four to five hours and hard in ten to twelve hours, after which it is said to resist effectively the action of heat, alcohol, gasoline and oil.

The Cullman Lathe Drive

IN the illustration is shown an application of the Cullman lathe drive, an individual electric motor drive for lathes which were originally designed to be operated by means of cone pulleys and a belt. The drive, built by the Cullman Wheel Company, 1344 Altgeld street, Chicago, consists of a bracket mounted on



The application of the Cullman lathe drive for motorizing belt-driven machines

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the back side of the lathe, a Cullman speed-reducing unit and drive shaft for mounting a cone pulley, a driving motor and a suitable table for mounting the various parts of the unit.

The upper end of the bracket is machined to receive a foundation shaft and is provided with clamping bolts to permit alining the bearings carrying the shaft. Two collars for side adjustments, the main bracket carrying the Cullman speed reducer with a shaft extension for mounting the cone pulley, the motor and a reversible drum switch are all mounted on the foundation shaft. A device for raising and lowering the cone pulley, to facilitate adjustment of belt tension, is also mounted on the foundation shaft together with a spring for supporting the weight when shifting the belt.

The unit is made in capacities of 1, 2, 3, 4 and 5 hp. for driving lathes ranging in size from 14 in. to 36 in. The belt shifting device lowers the cone pulley 1 in. on the 1-hp. and 2-hp. units while on the 3-hp., 4-hp. and 5-hp. units it lowers the pulley 1¼ in. On the extreme end of the raising and lowering device is an adjustable support that can be set at any convenient location on the lathe. The cone pulley which is mounted on the shaft extension driven by the speed reducer is the one originally used on the old countershaft.

Sparking-Out Attachments For Heald Grinders

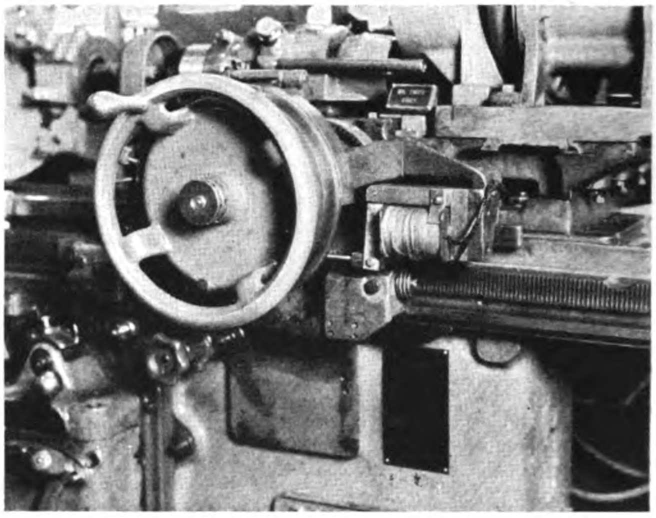
ON high precision internal grinding jobs requiring fine finish it is a well known fact that after the feed of the machine has been discontinued a certain period of time is required for the wheel to spark out. This sparking out is the natural dying out of a transverse pressure that is built up between the wheel and the work by the in-feeding function and which takes the form of a very minute spindle deflection.

Taking advantage of this condition, the Heald Machine Company, Worcester, Mass., has developed sparking-out attachments for the Gage-Matic and Size-Matic internal grinding machines which it manufactures. By automatically interrupting the cross feed and allowing sufficient time for the pressure present in the spindle to dissipate itself naturally as the wheel is reciprocated in the bore of the piece being ground, these attachments aid the machines materially in producting accurate and finely finished holes.

On the Gage-Matic, the hole is rought ground in the usual manner, the roughing gage attempting to enter the hole after each pass of the wheel until the gage does enter and cause the wheel to be withdrawn for dressing. The gage is of such size that after the work has been rough ground and the wheel has been trued, there is just enough stock left so that it will be removed by the pressure in the spindle when it is returned to the bore. The wheel, due to this pressure, then cuts itself free, bringing the hole to size and allowing the finish gage to enter which in turn causes the machine to go to rest position.

When the roughing gage enters, besides causing the wheel to withdraw for dressing, an electrical contact is made which actuates an electro magnet on the cross-slide unit, disengaging the feed pawl and holding it out of engagement with the feed ratchet throughout the finishing cycle. In other words the cross feed is automatically disengaged after roughing and the hole brought to size by the pressure remaining between the wheel and the work. The time required for the sparking out is governed by the amount of stock left in the hole after roughing and the adjustment of the truing diamond. Inasmuch as the roughing gage constitutes a definite and constant limit the amount of stock remaining can be held to a very small amount and hence the sparking out time to a correspondingly short period. An electrical connection between the coil of the magnet and the toggle switch on the control box of the machine serves to keep the magnet operative and the feed pawl disengaged until the finishing passes of the wheel have been completed and the table run out to rest position.

A micrometer diamond unit is used and it is important to note that the position of the diamond governs the finish obtainable. Moving the diamond inward trues more material off the wheel, hence the wheel goes back into the hole with a lighter pressure, and takes a larger number of passes to bring the hole to a finished size. This of course gives improved finish, and reduces production in the same ratio. The converse is equally true, that is, moving the diamond outward increases the production and gives a less perfect finish.



The time relay which permits the Heald Gage-Matic grinders to spark out, bringing the hole to accurate size after the cross feed has been disengaged

The sparking-out attachment for the Size-Matic consists of a time relay mounted on the machine to regulate the sparking-out time, and a cam attached to the top of the fine feed cam on the handwheel to stop the feed just after the finish contact on the handwheel is made.

The machine operates in the usual manner, except that when the finishing contact is made it engages the time relay instead of tripping the table dog, and the grinding wheel continues to reciprocate in the work without feeding. After a predetermined length of time, the time relay trips the table dog, which runs out the table to rest position.

The principle of operation of the Size-Matic device is that the wheel is always trued so that its working face is a certain distance from the finished size of the part being ground. That is to say, when the wheel reenters the work after dressing, the amount of pressure between the wheel and work is always the same within narrow limits. This allows a uniform amount of stock to be removed in a given length of time after the feed is stopped.

To vary the finish obtainable with this arrangement, it is necessary to adjust both the diamond and the time

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relay. To improve the finish, the diamond must be moved inward, and at the same time in order for this not to affect the size, the interval of the time relay must be increased. In other words, the diamond has precisely the same effect on finish as on the Gage-Matic with sparking-out attachment. On the Size-Matic machine, however, the diamond also governs the finished size of the piece. In order to prevent the size from becoming smaller as the diamond is moved inward, it is necessary that the interval of the time relay be increased to allow a greater length of time for sparking out. This increases the number of finishing passes, and compensates for the alteration in the diamond setting. Opposite adjustments produce the opposite effect.

Unit-Cylinder Clasp Brake for Tender Trucks

THE Unit-Cylinder tender-truck clasp brake, first applied to Canadian National Locomotive No. 5700, as described in the December issue of the *Railway Mechanical Engineer* is being supplied exclusively by American Steel Foundries. It has all the distinguishing characteristics of the present standard tender-truck brake with the addition of the Unit-Cylinder feature. Two small brake cylinders are applied at the inside ends of the truck frames. The cylinders actuate levers fulcrumed to the frame, and these levers, through the medium of pull rods, transfer the power to the main truck clasp brake.

The clasp brake, itself, comprises the usual system of double vertical levers which are connected by a horizontal lever to the brake cylinder mounted on each inside corner of the truck. As shown in the drawing, both clasp brake lever systems are connected to the same brake beams.

Heavy annealed copper pipe with heavy-duty fittings is rigidly attached to the truck frame and brought over to a point as close as possible to the center plate. A flexible metallic pipe is then used to connect this pipe to the main air brake pipe which is attached to the body of the tender. This permits the truck to swivel without a "break-in-two."

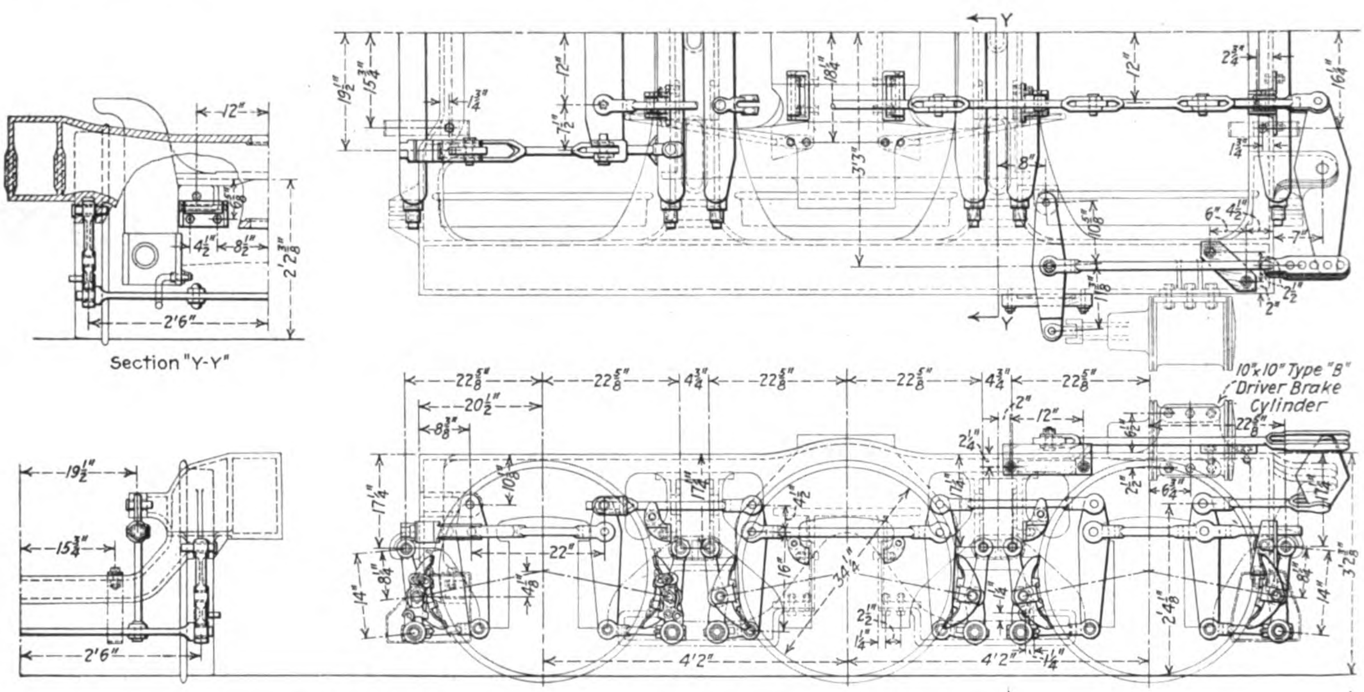
The Unit-Cylinder brake has many distinct advantages over the present tender-brake rigging, consisting of the truck brakes and the body brake, a few of the most outstanding of which will be mentioned.

The body brake is entirely eliminated, leaving that portion of the tender frame between the trucks clear for the application of stoker mechanism and other special equipment.

Trucks equipped with the Unit-Cylinder brake can be interchanged as a unit under other tenders with longer or shorter king pin centers, inasmuch as no body brake connecting rods or others affecting body conditions need be considered.

Considerable lost motion in brake rigging is eliminated with the new brake arrangement, insuring a more rapid brake application and shorter and easier stops.

On sharp curves there is a tendency toward twisting the truck levers on the usual truck and body brake application, due to the angular pull from the body brake which is supported from the tender frame. The Unit-Cylinder brake is an independent truck unit and is not affected by curves, regardless of their degree.



The Unit-Cylinder clasp-brake arrangement for tender truck applications

With the Unit-Cylinder brake, four 10-in. brake cylinders have sufficient power to brake practically any size of tender with a total ratio of 9 to 1, or under. The cylinders are easily accessible for packing renewal and more easily handled than the heavier and more bulky 16-in. or 18-in. cylinders generally used for body brakes.

A Unit-Cylinder brake has also been designed and built for application to six-wheel passenger-car trucks with an automatic slack adjuster used in conjunction with the cylinder arrangement. Here again the same advantages as on tenders are apparent, especially in the case of the elimination of all foundation brake rigging from the underside of the underframe, permitting the free use of this space for special equipment.

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Among the
Clubs and Associations

CANADIAN RAILWAY CLUB.—At the meeting of the Canadian Railway Club to be held in the York Room of the Windsor Hotel, Montreal, Canada, on February 9 at 8 p.m., the Hon. Duncan Marshall, late Minister of Agriculture, Alberta Government, will speak on Wheat and Its Relation to Canadian Farming.

NEW ENGLAND RAILROAD CLUB.—J. J. Pelley, president of the New York, New Haven & Hartford, will address the members of the New England Railroad Club at 6:30 p.m. on February 18 at the Copley-Plaza Hotel, Boston. It is expected that the presidents of all the New England railroads will be present at this meeting.

CLEVELAND RAILWAY CLUB.—The Cleveland Railway Club will hold its next and succeeding meetings at the Auditorium in the Brotherhood of Railroad Trainmen's building, West Ninth street and Superior avenue, Cleveland, Ohio. The time of meeting has also been changed from the first Monday to the second Monday of each month, the next meeting being on February 9 at 8 p.m. when there will be a continued discussion of the 1931 A.R.A. mechanical rules.

CINCINNATI RAILWAY CLUB.—Armco night will be the feature of the February 10 meeting of the Cincinnati Railway Club which will be held at 6 p.m. at the Roof Garden of the Hotel Gibson, Cincinnati, Ohio. J. P. Butterfield, assistant manager, development department, American Rolling Mill Company, Middletown, Ohio, will present a paper on the continuous mill process, illustrated by motion pictures. Musical entertainment and dinner will also be furnished.

SAINT LOUIS RAILWAY CLUB.—"How the Department of Agriculture of Illinois, through Its Division of Standardization and Markets, Aids the Railroads in Assisting the Farmers To Prepare Their Commodities for Shipment" will be the subject of a paper by Joe W. Cummins, chief inspector of the Division of Standardization and Markets, to be presented before the meeting of the Saint Louis Railway Club which will be held on Friday evening, February 13, at the Statler Hotel, St. Louis, Mo.

CENTRAL RAILWAY CLUB OF BUFFALO.—At the February 12 meeting of the Central Railway Club of Buffalo, which will be held at 8 p.m. at the Hotel Statler, Buffalo, N. Y., two papers will be presented as follows: The Effect of Machinery on Maintenance of Way Organization and Work, by Robert Faries, assistant chief engineer, Pennsylvania Railroad, Philadelphia, Pa., and The Ideal of a Perfect Performance, by T. H. Carrow, superintendent of safety, Pennsylvania Railroad, Philadelphia, Pa. Entertainment will be furnished by the Red Arrow Quartet.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—The new A.R.A. rules will be discussed at the meeting of the Car Foremen's Association of Chicago which will be held at the Great Northern Hotel, Chicago, at 8 p.m. on February 9. ¶ The meeting held at the Great Northern Hotel on Monday evening, January 12, was devoted entirely to a discussion of the new A. R. A. rules of interchange. Nearly 300 members of the association were present and, as usual, the argument regarding different points of some of the rules was quite heated. The discussion at that meeting proceeded as far as Rule 32.

CAR FOREMAN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—A paper on the Removal and Application of Wheels will be presented by N. A. Johnson, car foreman, Chicago, St. Paul, Minneapolis & Omaha, at the meeting of the Car Foreman's Association of Omaha, Council Bluffs and South Omaha Interchange to be held at 2 p.m. on February 12 at Omaha, Nebr. ¶At a banquet, which was held on January 24 at the Chieftan Hotel, Council Bluffs, M. P. Schmidt, organizer of the Car Foreman's Association of Omaha, Council Bluffs and South Omaha Interchange, was the guest of honor. Officers of various roads spoke of their acquaintance with Mr. Schmidt, who is general car foreman of the Chicago, Milwaukee, St. Paul & Pacific, and commended him for his good work in organizing the association which has brought about the expediting of cars through the interchange in a most economical and efficient manner. J. C. Rowe, superintendent of the Armour car shop and chairman of the entertainment committee, acted as toastmaster, and J. E. Mehan, assistant to the superintendent of the car department of the St. Paul, gave a talk on the loyalty and service which Mr. Schmidt has rendered to that road during his 48 years of service. Mr. Schmidt gave his reasons for starting the association and in his talk contrasted the discord existing at that time and the spirit of co-operation which now exists among the various foreman at Council Bluffs. The association was founded 30 years ago.

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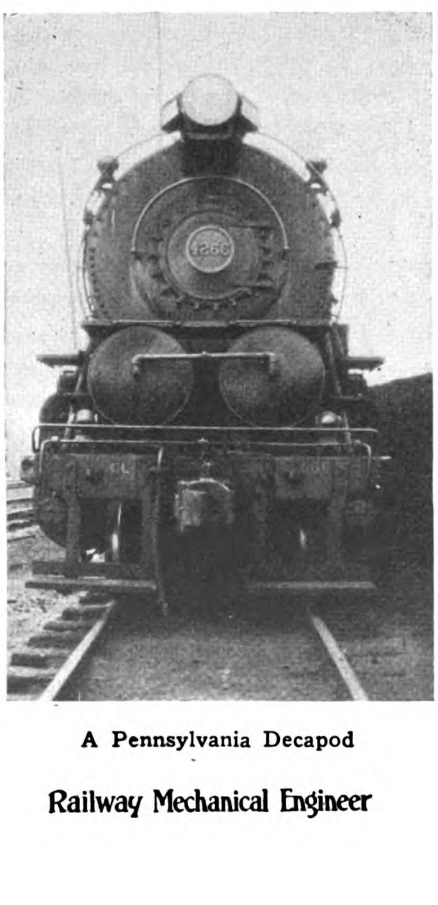

A Pennsylvania Decapod

FOURTH NATIONAL FUELS MEETING.—On Friday afternoon, February 13, at the Hotel Stevens, Chicago, a smoke abatement conference will be held in conjunction with the Fourth National Fuels meeting and Midwest Power conference. Experts in the efficient use of fuel for the development of power will assemble from all parts of the country and be available for advice in connection with smoke abatement work. John Hunter, consulting engineer, St. Louis, Mo., will preside at the smoke abatement conference, in the course of which papers will be presented on various important phases of smoke abatement activities, both in this country and abroad. The contribution of the railroads to air pollution by means of smoke will also be discussed, and railroad men will be invited to attend the conterence and take an active part in the solution of this pressing modern problem.

Club Papers

Air Conditioning

Western Railway Club.—Meeting held at Hotel Sherman, Monday evening, January 19. Paper on the Effect of Air Conditioning upon Human Beings, by L. L. Lewis, secretary, Carrier Engineering Corporation, Newark, N. J. ¶ In presenting his paper Mr. Lewis discussed fully the effects of air conditioning on the human body and showed a number of lantern slides indicating the relation of many variables which must be considered in the solution of the heating and ventilating problem. ¶ Following Mr. Lewis, F. A. Isaacson, engineer of car construction, Atchison, Topeka & Santa Fe, discussed the application of the Carrier air-conditioning equipment on a Santa Fe dining car, and A. E. Voight, car lighting engineer, described the pro-

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Engineers are hired to maintain SCHEDULES . . NOT to nurse BOILER TUBES

Schedules assume that engines and rolling stock in general will perform as intended; and unless that condition is fulfilled, schedules may go by the board.

An engineer is kept busy enough when things are normal. Every hour spent nursing a half-sick or limping engine is a hard hour for him, even if it does not result in actual delays and schedule derangement.

The strength, toughness and durability which are embodied in NATIONAL-SHELBY Seamless Locomotive Boiler Tubes, not only cut down replacements but, what is even more important, they give maximum assurance against annoying and costly interruptions and delays. A description of these tubes and their fitness for all the most exacting requirements of railway service, will be mailed upon request. Ask for a copy of National Bulletin No. 12 describing NATIONAL-SHELBY—

America's Standard Boiler Tubes

NATIONAL TUBE COMPANY

Frick Building, Pittsburgh, Pa.

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The Lorain Steel Company
Tennessee Coal, Iron & R. R. Company
Universal Atlas Cement Company

Pacific Coast Distributors—Columbia Steel Company, Russ Building, San Francisco, Calif. *Export Distributors*—United States Steel Products Company, 30 Church Street, New York, N. Y.

gram of inspection and maintenance which has been developed for dealing with this car. Mr. Voight said that the car has made 75,752 miles with a maintenance cost of only $305 as of January 8, 1931, and said that studies of the wear of the gear and pinion drive of the generators indicates a probable life of 290,000 miles, although he believes that belt drive can be used satisfactorily. Mr. Isaacson says that in winter a Vapor heating system unit is placed adjacent to the temporarily inactive Aerofin cooling coils and warm air is circulated through the same system which supplies cool air in summer. It is seldom necessary to use the customary side-wall heating coils.

Oil Engines for Railway Service

Canadian Railway Club.—Meeting held in the Windsor Hall of the Windsor Hotel, Montreal, November 17, 1930. Paper presented by C. E. Brooks, chief of motive power, Canadian National, entitled "Development of the Oil Engine for Railway Service." ¶ Mr. Brooks divided his paper into two parts as follows: The general application of the oil engine to railway use, and the development of what may be considered a suitable engine for these purposes. He reviewed the developments during the past seven years in oil-engine design, maintenance costs, reliability, serviceability, and lubrication. Theoretically, he said, the greatest fuel saving possible in a service of any kind is by the elimination of standby losses, and as switching service represents a form of operation where fluctuations of load and idle time are at a maximum, it would appear to offer the best field for the internal-combustion engine. As a basis of study of this problem, the Canadian National studied a number of representative switching shifts which were carefully analyzed by means of continuous indication of all power strokes of the engine. ¶ Taking into consideration, Mr. Brooks said, all conditions which we are able to develop, the 450-h. p. oil-electric switcher represents a saving per 24 hours or three shifts, of at least $40. This will amply meet all costs over and above the cost of a standard steam-locomotive switcher capable of performing the same operations. ¶ In conclusion, Mr. Brooks stated that it appears reasonable to expect, in view of the development of internal-combustion engines for other purposes, that the design of the oil engine also will make such progress year by year as will better suit it for the railroad field. One thing is certain, he pointed out, and that is if the oil engine is to be used extensively in railway service, it must be simplified and all parts which require frequent examination must be made more accessible than has been done in the past.

Heating Passenger Trains

Manhattan Air Brake Club.—Meeting held in Room 2300, 150 Broadway, New York, January 16. Talk by R. P. Cooley, district manager, Vapor Car Heating Company, Inc., on "Passenger Train Steam Heating." ¶ Mr. Cooley gave an informal talk to the members of the Manhattan Air Brake Club on questions pertaining to the heating of passenger cars. He included in his remarks descriptions of a number of mechanical improvements made to secure improved heating of long passenger trains. In the course of his remarks he described some of the important developments and improvements in the steam heating equipment for gas-electric rail cars

The Transportation Situation

Southern & Southwestern Railway Club.—Meeting held January 15, 1931, at the Ansley Hotel, Atlanta, Georgia. Address by A. E. Clift, president, Central of Georgia, on "Things the Public Should Know About the Transportation Situation." ¶ In introducing his remarks, Mr. Clift stated that the members of the Southern & Southwestern Railway Club have a direct personal interest in the railroad industry, its present problems and its future prospects. That statement, he said, would have been accurate if made at any time during the past and it holds good today, but it does not go far enough. The truth is, he said, that the transportation situation in the United States at the beginning of 1931 ought to be a matter of direct and vital concern to everyone in the country, because it is no longer a question of operation, or of efficiency, or of any other managerial function. It has taken on the broader economic aspect of a national problem. ¶ The railroads as an industry, Mr. Clift pointed out, are passing through a critical period, and many public men and business man are doing practically nothing to assist them, but on the contrary are further hampering them by favoring policies and practices that tend to curtail further the traffic and the earnings of the railroads. Mr. Clift reviewed the economic situation of the railroads during recent years and pointed out the inequalities of opportunity between the railroads and their competitors. He said that the railroads are asking no favors, no preferential treatment, but only a square deal and fair treatment.

Further Possibilities for Locomotive Utilization

St. Louis Railway Club.—Meeting at St. Louis, January 10, 1931. Paper entitled "Further Possibilities of Efficiency in Railroad Transportation," by D. L. Forsythe, general road foreman of engines, St. Louis-San Francisco. ¶ From the wealth of his experience covering many years in railroad service, Mr. Forsythe gave the members of the club a new appreciation of the development of steam locomotives, from the simple machines first used to the complicated and power-

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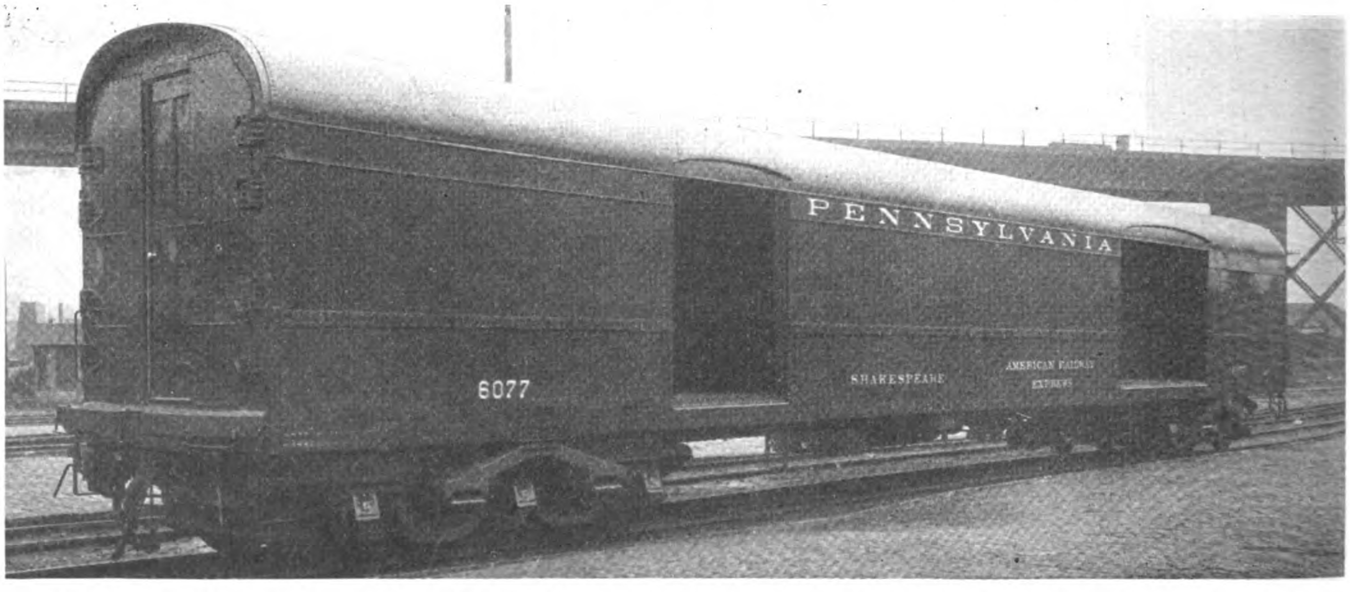
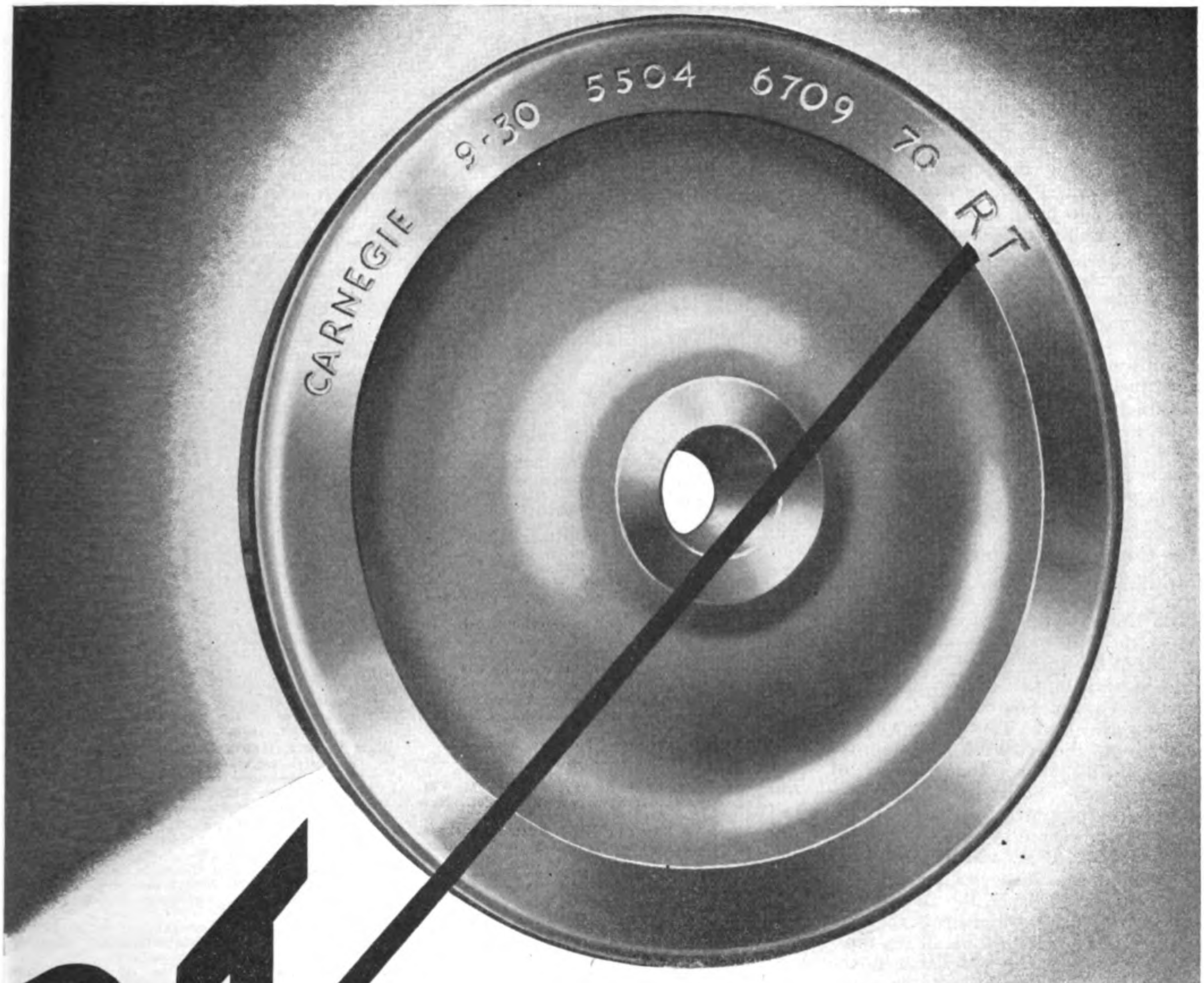


The "Shakespeare"—One of a number of Pennsylvania express cars named after famous actors and actresses for the transportation of scenery used in theatrical productions



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ful units now forming such an important part of the railroad transportation machine. He stressed the necessity of increased utilization of locomotives and said that, with proper attention to details, locomotives can now be made to produce as many ton-miles in a month as they formerly did in three months. ¶ Mr. Forsythe described in outline long locomotive runs now being made by a number of roads, as well as tests conducted on the St. Louis-San Francisco and previously reported in these columns. He predicted runs in the no-distant future of 2,000 to 3,000 miles, without changing power, and locomotive tanks built to hold 30,000 gal. of water, 30 tons of coal or 8,000 gal. of fuel oil. He closed his paper with an earnest appeal for more attention to the human element in efficient locomotive operation, without which all mechanical features will be more or less non-effective.

Air Conditioning on Passenger Equipment

New York Railroad Club.—Meeting held at the Engineering Societies Building, 29 West thirty-ninth street, New York, January 16, 1931. Paper by R. W. Waterfill, Carrier Engineering Company, Newark, N. J. ¶ This was a joint meeting of the New York Railroad Club and the Metropolitan Section of the American Society of Mechanical Engineers. Mr. Waterfill's paper, which was sponsored by the Railroad Division, A. S. M. E., was entitled "Air Conditioning on Passenger Equipment." In introducing his paper, the author stated that true air conditioning is the production and maintenance of all the qualities of air, as near as practicable to the ideal for the service performed. The qualities at present most frequently controlled by air conditioning are temperature, humidity, purity, cleanliness, odors, motion and quietness. In some special applications which are at present mainly experimental, he said, qualities which change but little in nature are altered and controlled. These include pressures, oxygen content, the introduction or substitution of other gases and artificial light. Air conditioning, he pointed out, may involve control of any or all of these qualities when benefiting the application practically. ¶ Mr. Waterfill said it is erroneous to assume that air is healthy just because it has been conditioned. Like everything else air conditioning can be overdone, or poorly done. A great deal of harm is frequently done by so altering the properties of air that it is less desirable than originally. Mr. Waterfill's paper included tabular data showing the desirable indoor temperatures in summer, corresponding to outdoor temperatures. The paper covered briefly a number of improvements in the mechanical design of air conditioning equipment. The most important of which was the building of a centrifugal type machine in which it is possible to use existing refrigerants that present no hazards, such as those which make ammonia objectionable.

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

Air-Brake Association.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

American Railway Association.—Division V.—Mechanical.—V. R. Hawthorne, 59 East Van Buren street, Chicago.
Division V.—Equipment Painting Section.—V. R. Hawthorne, Chicago.
Division VI.—Purchases and Stores.—W. J. Farrell, 30 Vesey street, New York.
Division I. — Safety Section. — J. C. Caviston, 30 Vesey street, New York.
Division VIII.—Car Service Division.—C. A. Buch, Seventeenth and H streets, Washington, D. C.

American Railway Tool Foremen's Association.—G. G. Macina, 11402 Calumet avenue, Chicago.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.
Railroad Division.—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York. Spring meeting April 20-23, Birmingham, Ala.
Machine Shop Practice Division. — Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.
Materials Handling Division.—M. W. Potts, Alvey- Ferguson Company, 1440 Broadway, New York.
Oil and Gas Power Division.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.
Fuels Division.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

American Society for Steel Treating.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

American Society for Testing Materials.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa

American Welding Society.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

Association of Railway Electrical Engineers.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

Association of Railway Supply Men.—J. W. Fogg, MacLean-Fogg Lock Nut Company, 2649 N. Kildar avenue, Chicago. Meets with International Railway General Foremen's Association.

Boiler Maker's Supply Men's Association.—Frank C. Hasse, Oxweld Railroad Service Company, 230 N. Michigan avenue, Chicago. Meets with Master Boiler Makers' Assoc.

Canadian Railway Club.—C. R. Crook, 2276 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month except in June, July and August, at Windsor Hotel, Montreal, Que.

Car Department Officers Association.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

Car Foremen's Association of Chicago.—G. K. Oliver, 3001 West Thirty-ninth Place, Chicago, Ill. Regular meeting, second Monday in each month, except June, July and August, Great Northern Hotel, Chicago, Ill.

Car Foremen's Club of Los Angeles.—J. W. Krause, 608 South Main street, Los Angeles, Cal. Meetings second Monday of each month except July, August and September, in the Pacific Electric Club building, Los Angeles, Cal.

Car Foreman's Association of Omaha, Council Bluffs and South Omaha Interchange.—Geo. Kriegler, car foreman, Chicago, Burlington & Quincy, Sixteenth avenue and Sixth streets, Council Bluffs, Iowa. Regular meetings, second Thursday of each month at Council Bluffs.

Car Foremen's Association of St. Louis.—F. G. Weigman, 720 North Twenty-third street, East St. Louis, Ill. Regular meeting first Tuesday in each month, except July and August, at American Hotel Annex, St. Louis, Mo.

Central Railway Club of Buffalo.—T. J. O'Donnell, 1004 Prudential building, Buffalo, N. Y. Regular meeting, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

Cincinnati Railway Club.—D. R. Boyd, 453 East Sixth street, Cincinnati. Regular meeting second Tuesday, February, May, September and November.

Cleveland Railway Club.—F. L. Frericks, 14416 Adler avenue, Cleveland, Ohio. Meeting second Monday each month, except July, August and September, at the Auditorium, Brotherhood of Railroad Trainmen's building, West Ninth and Superior avenue, Cleveland.

Eastern Car Foremen's Association.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings fourth Friday of each month, except June, July, August and September.

Indianapolis Interchange Car Inspection Association.—E. A. Jackson, Box 22, Mail Room, Union Station, Indianapolis, Ind. Regular meetings first Monday of each month at Hotel Severin, Indianapolis, at 7 p.m. Noon-day luncheon 12:15 p.m. for Executive Committee and men interested car department.

International Railroad Master Blacksmith's Association.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

International Railroad Master Blacksmith's Supply Men's Association.—J. H. Jones, Crucible Steel Company, of America, 650 Washington boulevard, Chicago.

International Railway Fuel Association.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago.

International Railway General Foremen's Association.—William Hall, 1061 W. Wabash street, Winona, Minn.

International Railway Supply Men's Association.—W. J. Dickinson, acting secretary, 1703 Fisher building, Chicago. Meets with International Railway Fuel Association.

Louisiana Car Department Association.—L. Brownlee, 3730 South Prieur street, New Orleans, La. Meetings third Thursday.

Master Boilermaker's Association. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

Master Car Builders' and Supervisors' Association.—See Car Department Officers Association.

National Safety Council—Steam Railroad Section: W. A. Booth, Canadian National, Montreal, Que. William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

New England Railroad Club.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting, second Tuesday in each month, excepting June, July, August and September. Copley-Plaza Hotel, Boston.

New York Railroad Club.—Douglas I. McKay, executive secretary, 26 Cortlandt street, New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York.

Pacific Railway Club.—W. S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

Pueblo Car Men's Association.—I. F. Wharton, chief clerk, Interchange Bureau, Pueblo, Colo.

Railway Business Association. — Frank W. Noxon, 1124 Woodward building, Washington, D. C.

Railway Car Men's Club of Peoria and Pekin.—C. L. Roberts, chief clerk, Peoria & Pekin Union Railway, 217 Lydia avenue, Peoria, Ill.

Railway Club of Greenville.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meetings third Tuesday of each month, except June, July and August.

Railway Club of Pittsburgh.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Regular Meeting fourth Thursday in month, except June, July and August. Ft. Pitt Hotel, Pittsburgh, Pa.

Railway Equipment Manufacturers' Association.—F. W. Venton, Crane Company, 836 South Michigan avenue, Chicago. Meets with Traveling Engineers' Association.

Railway Fire Protection Association.—R. R. Hackett, Baltimore & Ohio, Baltimore, Md.

Railway Supply Manufacturers' Association.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

St. Louis Railway Club.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

Southern and Southwestern Railway Club.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, June, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

Supply Men's Association. — E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division, American Railway Association.

Supply Men's Association.—Bradley S. Johnson, W. H. Miner, Inc., Chicago. Meets with Car Department Officers Association.

Traveling Engineers' Association. — W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio.

Western Railway Club.—W. J. Dickinson, 343 South Dearborn street, Chicago. Regular meetings, third Monday in each month.

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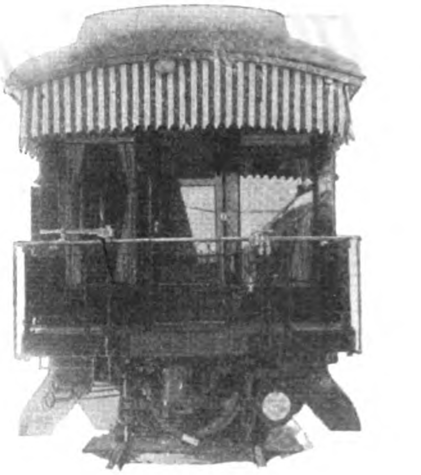
NEWS



Second Arc-Welding Contest Rules

DETAILS concerning the second Lincoln arc-welding prize competition, which will close on October 1 of this year, are now being distributed by the Lincoln Electric Company, Cleveland, Ohio. The competition, the purpose of which is to increase the knowledge of the adaptability of arc welding to industry as announced in the November, 1930, issue of the *Railway Mechanical Engineer,* is open to any person, or group of two or more persons, in any country of the world. The subject matter of the papers submitted must come under one of the following headings: (a) A description of a useful machine, structure, or building, previously made in some other way, that has been redesigned in whole or in part, so that arc welding is applied to its manufacture; (b) A description of a machine, structure, or building, not previously made that has been designed in whole or in part to the use of arc welding and a description showing how a useful result is obtained which was impractical by means of other methods of manufacture.

The first six prizes will range from $7,500 down to $250, and for the seventh to fortieth prize papers $100 each will be awarded.

B. & O. To Equip Train for Air Conditioning

THE YORK ICE MACHINERY CORPORATION of York, Pa., has received an order from the Baltimore & Ohio to equip with air conditioning machinery all coaches used on the Columbian, operating between Washington, D. C., and New York. The order covers diners, club, observation and chair cars.

The equipment to be installed has been designed jointly by Baltimore & Ohio engineers and the engineering department of the York Company after extensive experimenting and will supersede the style of ventilation now in use. It will permit of ventilation of the coaches at controlled temperatures without admission of smoke or dust.

Each coach will be equipped with a complete air conditioning unit electrically powered, thus providing constant operation whether the car is in motion or standing. The equipment is designed to give a complete change of fresh air in each coach every two minutes at any desired temperature and will make unnecessary opening of windows in summer months or any other period of the year. Air admitted when doors are opened is immediately taken up by the system and passed through the conditioning process.

Hudson County Smoke Ordinance

THE BOARD OF HEALTH & Vital Statistics of Hudson County, New Jersey, has adopted a smoke ordinance prohibiting the making of dense smoke within the limits of the county, and establishing a department on smoke regulation. The rules define smoke as No. 3, No. 2, etc., according to the Ringelmann chart. Absolute prohibition is modified by certain exceptions; for example, there is an exception of a locomotive or a steamboat emitting dense smoke not more than two minutes in any period of 15 minutes. Other regulations measure the duration of offenses by half minutes. The construction or alteration of any furnace or stack, etc., can be carried out only on a permit from the smoke department. Violations of the ordinance will incur a penalty of fine or imprisonment or both.

An advisory board of three engineers has been appointed, consisting of Dr. Harvey N. Davis, Roy V. Wright, editor of the *Railway Mechanical Engineer,* and Professor E. H. Whitlock of Stevens Institute of Technology.

C. A. Gill to Undertake Reorganization of Russian Railroads

CHARLES A. GILL, superintendent of motive power, Eastern lines of the Baltimore & Ohio, has been selected by a commission representing the Russian Government to take charge of the modernization of all steam transportation systems in the Union of Socialist Soviet Republics. Mr. Gill, who has been given a leave of absence by the B. & O., has sailed for Russia, taking with him a staff of American railway experts representing practically all branches of the industry. His appointment, which was made following an inspection of railroad methods in nearly every country in the world by groups of Russian railway officials, similar to the party which visited the United States and Canada last summer, gives him jurisdiction over approximately 22,000 miles of main line extending from Moscow to Vladivostok.

Mr. Gill gained his first railroad experience as a machinist with the Baltimore & Ohio. After working on a number of other railroads he returned to the B. & O. as enginehouse foreman, and was promoted to his present position of superintendent of motive power, in 1917.

Co-incident with Mr. Gill's appointment, the Soviet authorities have also decided upon the "mobilization," in the full military sense of the word, of all persons competent to undertake railroad service, according to a dispatch from Moscow to the New York Times. The order, which is based upon a necessity of completely re-organizing the Soviet railway system, requires that all state departments, except those engaged in transportation or national defense, must submit within ten days a list of all their employees who formerly had any experience in or in connection with railway work. Such employees are to be immediately dispatched and are required to report within five days to government labor exchanges where they will be assigned new railroad jobs. Criminal proceedings will be taken against employees who try to evade the present order by concealing previous experience and against employers who permit such concealment or submit a false list.

Rock Island Consolidates Divisions

THE CHICAGO, ROCK ISLAND & PACIFIC, on January 1, consolidated its Dakota division with the Iowa and Cedar Rapids-Minnesota divisions. The portion of the Dakota division between Short Line Junction (Des Moines), Iowa, and Minneapolis, Minn., has been absorbed by the present Iowa division and the name of the latter has been changed to the Iowa-Minnesota division. The headquarters of the Iowa-Minnesota division will remain at Des Moines. The remainder of the Dakota division, which had its headquarters at Estherville, Iowa, has been absorbed by the present Cedar Rapids-Minnesota division, and the name of that division has been changed to Cedar Rapids-Dakota division. The headquarters of the Cedar Rapids-Dakota division will remain at Cedar Rapids, Iowa.

On the same date the jurisdiction of the operating officers of the Rock Island, including general, district and Illinois division officers was extended over the Peoria Terminal. The Peoria Terminal has begun the operation under lease of the Peoria, Hanna City & Western, extending from Hollis Junction, Ill., to Mine No. 6, about 5 miles.

Supply Trade Notes

ROBERT LEE WILSON, assistant to the president of the Westinghouse Electric & Manufacturing Company, has resigned.

THE AMERICAN CHAIN COMPANY, INC., has moved its Boston, Mass., office from 132 High street to the Statler building.

THE INLAND STEEL COMPANY plans to construct a sheet, plate and strip mill at its Indiana Harbor, Ind., plant during the spring.

L. F. RAINS, vice-president of the Columbia Steel Corporation, has been elected president of the A. M. Byers Company, Pittsburgh, Pa.

HARRY S. RANSOM, special representative of the sales and engineering department of the Fort Pitt Steel Casting Company, McKeesport, Pa., has been appointed manager of sales.

WILLIAM K. KREPPS, manager of the eastern railroad department of the Crucible Steel Company of America, at New York, has been appointed general manager of the railroad department of that company, with headquarters at New York.

THE WASHINGTON, D. C., office of the American Steel Foundries has been discontinued and the headquarters of C. B. Peirce, Jr., had been transferred from that city to the office of the American Steel Foundries at 30 Church street, New York.

J. C. KEENE, special representative of the Bradford Corporation, has been appointed also manager of railway sales, Midwest district, Durametallic Corporation, with offices in the Pure Oil building, 35 E. Wacker drive, Chicago.

THE PANGBORN CORPORATION, Hagerstown, Md., has opened district sales offices in Cincinnati, Ohio, and Milwaukee, Wis. Thomas J. Dougherty has been appointed special sales engineer at the home office to cover the Hagerstown district.

THE ALUMINIUM COMPANY OF AMERICA, Pittsburgh, Pa., at a recent meeting of the board elected E. S. Fickes, G. R. Gibbons, and R. E. Withers senior vice-presidents; Harwood Byrnes, S. K. Colby, W. C. Neilson, G. J. Stanley, P. J. Urquhart, and I. W. Wilson, were elected vice-presidents.

RALPH W. BURK, manager of the Detroit branch office of the Kearney & Trecker Corporation, Milwaukee, Wis., has been promoted to the position of sales manager, Eastern division, to supervise and assist the company's representatives in several eastern territories. Mr. Burk's headquarters will be at Philadelphia.

THE AMERICAN MANGANESE STEEL COMPANY, Chicago Heights, Ill., has appointed the Southern Tractor Supply Company, 406 Geer building, Durham, N. C., its representative for the District of Columbia, North Carolina, South Carolina, Eastern Tennessee, Virginia and West Virginia.

H. E. PASSMORE has been appointed assistant to the president of the Verona Tool Works with headquarters at Oakmont, Pa. The R. H. Hyland Company, 225 West Huron street, Chicago, has been appointed representative of the Verona Tool Works for the Chicago territory to succeed Porter Laughlin, resigned.

THE MOHAIR INSTITUTE has been organized and will open headquarters at 7 South Dearborn street, Chicago. The Institute has been formed to further the interests of the American mohair industry. Mohair used in railroad car upholstery will be given special attention. A. C. Gage, editor of the Angora Journal, will be the director of the Institute.

THE JAMES H. KNAPP COMPANY, Los Angeles, Cal., with a branch at San Francisco, has been appointed exclusive Pacific Coast distributor of the products of the Illinois Testing Laboratories, Inc., Chicago, consisting of portable and stationary indicating pyrometers, resistance thermometers and other electrical and magnetic measuring instruments.

THE SOUTHWARK FOUNDRY & MACHINE COMPANY, has transferred the major portion of its asses to the Baldwin-Southwark Corporation, at Eddystone, Pa. The latter corporation has assumed all outstanding liabilities and is carrying on the entire business formerly done in the name of the Southwark Foundry & Machine Company.

THE LINDE AIR PRODUCTS COMPANY, New York, is now handling the products of the Union Carbide & Carbon Corporation units which are used mainly for oxy-acetylene welding and cutting. These products include Linde oxygen, Union carbide, Prest-O-Lite dissolved acetylene, and Oxweld, Prest-O-Weld and Purox apparatus and supplies.

THE MANUFACTURING OPERATIONS of the Fuller Lehigh Company are to be transferred from Fullerton, Pa., to the Barberton, Ohio, works of the Babcock & Wilcox Company. The management, engineering and sales departments will move to New York City. E. G. Bailey, president of the Fuller Lehigh Company, has been elected a vice-president of the Babcock & Wilcox Company.

R. R. WEDDELL, chief engineer of the O. K. Tool Company, Shelton, Conn., has been appointed sales manager, and E. Reaney succeeds Mr. Weddell as chief engineer. A. Curry has been appointed production manager, succeeding Ole Severson who is now in charge of all development and research work. H. Giller, formerly chief tool supervisor of the Chrysler Motor Car Company, is now representing the O. K. Tool Company in the Detroit territory, with headquarters at 5235 Buckingham avenue, Detroit. Mr. Giller succeeds J. Costello who has been appointed assistant sales manager, contacting the machine tool trade.

H. HENGEVELD, who retired on January 1 as master painter of the Atlantic Coast Line, has become a member of the sales force of The Lowe Brothers Company, Dayton, Ohio. Mr. Hengeveld, whose age is seventy years, was forty-two years in the service of the Atlantic Coast Line. For a number of years he has been a member of the Committee of Direction of the Equipment Painting Section of the American Railway Association.

THE GLOBE STEEL TUBES COMPANY, Milwaukee, Wis., has organized a subsidiary, the Globe Stainless Tube Company, to carry on a business of engineering, designing and manufacturing stainless steel tubes and tubular installations for corrosion and heat-resisting purposes. The principal officers of the new company will be the same as of the Globe Steel Tubes Company and sales will be handled through the same offices in principal cities.

CLIFFORD L. SHEEN, sales representative of the American Locomotive Company and Railway Steel-Spring Company at the San Francisco, Cal., district sales office has been appointed general sales representative on the Pacific Coast for both companies, with the title of district sales manager and headquarters at the present office in the Rialto building, San Francisco. Otis R. Hale, former district sales manger at San Francisco, has retired. Mr. Sheen, after completing an apprenticeship of four years in the shops of the Chicago & North Western at Clinton, Iowa, entered the service of the American Locomotive Company in 1920 and until 1925 served as an inspector in the various departments of the company's Cooke plant at Paterson, N. J., and later was appointed a traveling engineer for the company for service in South America. He subsequently served in the same capacity in the United States and in 1927 when he was transferred to the San Francisco district office he was appointed a sales and service representative.

A. E. BALLIN, president and a director of the McIntosh & Seymour Corporation, Auburn, N. Y., a division of the American Locomotive Company, has retired, and R. B. McColl, manager of the Schenectady plant of the American Locomotive Company, succeeds Mr. Ballin as president and a director of the McIntosh & Seymour Corporation. R. P. Allison, manager of the Dunkirk, N. Y., plant of the American Locomotive Company, succeeds Mr. McColl as manager at Schenectady, and John S. Stevenson, in charge of general development work of the American Car & Foundry Company at New York, succeeds Mr. Allison as manager of the Dunkirk plant.

T. K. QUINN, Cleveland, Ohio, and Charles E. Wilson, Bridgeport, Conn., have been elected vice-presidents of the General Electric Company; H. H. Barnes, Jr., New York, has been appointed a commercial vice-president in charge of the New York district, and J. L. Buchanan, Bridgeport, Conn., has been appointed president of the General Electric Supply Corporation. Charles E. Patterson, vice-

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president in charge of the merchandise department of the General Electric Company, and Cummings C. Chesney, one of the two vice-presidents in charge of manufacturing, have retired.

THE MILWAUKEE ELECTRIC CRANE & HOIST CORPORATION, which has been operated as a subsidiary of the Harnischfeger Corporation since 1928, has been consolidated with the parent company and is being operated as the Milwaukee division. D. E. Patterson, general manager of the Milwaukee Crane and vice-president of the Harnischfeger Sales Corporation, is in charge of the crane and hoist sales. Carl Haugaard has been appointed assistant treasurer of the Harnischfeger Corporation, and Walter Harnischfeger, vice-president, has been elected president and treasurer to succeed Henry Harnischfeger, deceased.

R. R. WASON has been elected president of Manning, Maxwell & Moore, Inc., New York, to succeed C. A. Moore, who was president of the company since April, 1927. Mr. Moore retains his contact with the company as chairman of the board of directors. Mr. Wason was also elected president of the Consolidated Ashcroft Hancock Company, Inc., one of the subsidiaries of Manning, Maxwell & Moore, Inc. Mr. Wason's entire career has been connected with merchandising and management problems. He was for many years director of merchandising of the Proctor & Collier Company, Cincinnati, Ohio. Early in 1922 he came East to represent banking interests in the Clark Lighter Company.

JAMES K. AIMER has been appointed assistant general manager of sales in charge of railroad, locomotive and car equipment sales, also bar iron and billets sales for the Reading Iron Company, Reading, Pa. Mr. Aimer's headquarters are at 230 Park avenue, New York. In addition to the supervision and direction of all sales to railroads, Mr. Aimer will direct the sales of Reading charcoal iron boiler tubes, formerly under the direction of George H. Woodroffe, metallurgical engineer. Mr. Woodroffe will now handle all complaints and serve in an advisory capacity to the general sales organization with respect to technical problems. F. W. Deppe, district sales representative at St. Louis, Mo., has been appointed general manager of sales with offices at New York.

JOSEPH T. RYERSON & SON, INC., Chicago, has acquired the lines of Maximillers, production millers and automatic indexing machines heretofore produced by the Kempsmith Manufacturing Company of Milwaukee, Wis. The transfer involves an outright purchase of good will, patents, patterns, and other assets pertaining to these lines. The cone drive milling machines produced by the Kempsmith Company are not involved in the transaction. The Ryerson Company will act as general distributors of the Kempsmith line, direct the sales policy and furnish through a special engineering staff, including Walter Mickelson, formerly associated with Kempsmith, the necessary services to the trade and support to its local sales agencies in the active promotion of these machine tools. The Sidney Machine Tool Company of Sidney, Ohio, manufacturers of engine lathes, will take over for the Ryerson Company full manufacturing responsibilities in the building of the former Kempsmith products, and will discontinue the building of its older type of engine lathes, confining its efforts to the production of the milling machine line and the Monotrol and Tritrol types of lathes. H. L. Livesay, former factory manager of the Kempsmith Company, has been placed in full charge of the production of milling machines at the Sidney plant.

Obituary

GEORGE SHIELDS, eastern sales manager for The Dayton Manufacturing Company, with office at 25 Church street, New York, died on December 25.

WILLIAM S. BARTHOLOMEW, retired president of the Locomotive Stoker Company and a retired vice-president of the Westinghouse Air Brake Company, died on January 6, at his home, Pittsburgh, Pa., following a short illness from a heart attack. Mr. Bartholomew was born on November 17, 1864, at Warren, Ohio, and received his early education at Detroit, and at Chicago, where he also later matriculated in Northwestern University. His first business training was received in

William S. Bartholomew

the ship chandlery business, from which he went to the Adams & Westlake Company, eventually becoming the company's eastern manager in Philadelphia. In 1903 he became associated with the Westinghouse Air Brake Company as its New England representative at Boston, Mass., being transferred in 1905 to Chicago as its western manager. In 1913 he became president of the Locomotive Stoker Company, a subsidiary of the Westinghouse Air Brake, at Schenectady, N. Y., and since 1916, when the plant of that company was moved to Pittsburgh, Mr. Bartholomew has lived there. As executive head of the Locomotive Stoker Company Mr. Bartholomew developed the mechanical stokers used in locomotives throughout the United States and in foreign countries. In addition to these duties, in 1918 he became vice-president of the Westinghouse Air Brake Company in charge of sales. He retired in 1928.

Personal Mention

General

GEORGE WHITELEY, assistant superintendent of motive power, eastern lines, of the Canadian Pacific, has been appointed superintendent of motive power.

ALEXANDER PEERS, master mechanic of the British Columbia district of the Canadian Pacific, has been promoted to assistant superintendent of motive power at Montreal.

G. S. WEST, master mechanic of the Philadelphia Terminal division of the Pennsylvania, with headquarters at West Philadelphia, Pa., has been appointed acting superintendent of motive power of the Southwestern division, with headquarters at Indianapolis, Ind.

P. M. HAMMETT, superintendent of motive power of the Maine Central, has retired. Mr. Hammett had been in railroad service for forty years. He was appointed master mechanic of the old Boston shop of the Boston & Maine in July, 1896. When the Boston & Maine acquired the Fitchburg Railroad in 1900, he was appointed assistant superintendent of motive power. He continued in that position until his appointment as superintendent of motive power of the Maine Central.

FRANCIS G. LISTER, who has been promoted to assistant general superintendent of motive power of the St. Louis San Francisco, with headquarters at Springfield, Mo., has been engaged in railway work for nearly 30 years. He was born at Marysville, Kan., on July 8, 1882, and attended the University of Nebraska for two years. He entered railroad service in 1901 as a special apprentice on the Wabash, and in the following year was advanced to the position of mechanical draftsman. In 1906 he became a locomotive and car draftsman in the employ of the Northern Pacific; in 1911, appointed chief draftsman, and later mechanical engineer of the Spokane, Portland & Seattle and a number of subsidiaries which are now a part of that railroad. In 1916 he became mechanical engineer of the El Paso & Southwestern. When the latter road became a part of the Southern Pacific in 1924 he was appointed master car repairer at El Paso, Tex. Mr. Lister was appointed chief mechanical engineer of the Frisco, with headquarters at Springfield, in 1926, his promotion to assistant general superintendent of motive power becoming effective on January 1.

F. W. HANKINS, chief of motive power of the Pennsylvania at Philadelphia, Pa., has been promoted to the position of assistant vice-president, operation, and will also continue as chief of motive power. Mr. Hankins was born in London, England, in 1876, and came to this country in 1880. He received his education in the public schools at Foxburg, Pa., and began his railroad career with the Pittsburgh &

(Continued on next left-hand page)

Western (now a part of the Baltimore & Ohio) on April 1, 1891, as a machinist apprentice. He completed his apprenticeship in 1894, and served as a machinist with the B. & O. at Allegheny, Pa., for two years, beginning work with the Pennsylvania at Pittsburgh, Pa., on July 8, 1897, as a machinist. From 1901 to 1905, Mr. Hankins served as acting enginehouse foreman, machinist and leading machinist at Pittsburgh, and from April, 1905 to January 1, 1919, served successively as enginehouse foreman, machine shop foreman, general foreman and master mechanic of the Cumberland Valley (now a part of the Pennsylvania) at Chambersburg, Pa. During the period of Federal control, he was transferred as master mechanic to the office of the general superintendent of motive power of the Pennsylvania, with headquarters at Philadelphia, Pa., and on May 1, 1923, became general superintendent of motive power of the Central region at Pittsburgh. Mr. Hankins became chief of motive power of the entire system on March 1, 1927.

Frederick W. Hankins

E. W. SMITH has been appointed co-receiver of the Seaboard Air Line. Mr. Smith was born in Clarksburg, W. Va., on September 21, 1885. He is a graduate of the Virginia Polytechnic Institute, class of 1905. He entered railway service in June of that year and served in various positions in the motive power department of the Pennsylvania. He was appointed assistant master mechanic at Wilmington, Del., in October, 1913; was transferred in the same capacity to Altoona, Pa., in April, 1915, and the following year became assistant engineer of motive power. He was transferred to Harrisburg, Pa., on October 10, 1917, as master mechanic, and on May 26, 1918, was transferred to Williamsport as superintendent of motive power. He returned to Altoona as superintendent of motive power in December, 1919, and the following year was promoted to engineer of transportation on the staff of the vice-president in charge of operation at Philadelphia. He was appointed general superintendent of motive power at St. Louis, Mo., on October 15, 1922; two years later was promoted to general superintendent of the Western Pennsylvania division and in September, 1926, was appointed general manager of the Eastern region. Mr. Smith, in September, 1928, was advanced to regional vice-president of the Pennsylvania, from which position he resigned.

E. W. Smith

J. W. SURLES, who has been promoted to superintendent of motive power of the St. Louis-San Francisco, with headquarters at Springfield, Mo., has been connected with the mechanical departments of the Illinois Central, the Southern Pacific, the Frisco and the Grant Locomotive & Car Works at Houston, Tex., for 39 years. The positions he has held have included those of superintendent of shops of the Southern Pacific at Houston and of the Frisco at Springfield, being appointed to the latter post in 1923. A complete sketch of Mr. Surles' railway career appeared in the June, 1930, issue of the *Railway Mechanical Engineer,* at the time of his promotion to assistant superintendent of motive power of the Frisco.

J. W. Surles

WILLIAM R. WOOD, who has been promoted to assistant general superintendent of motive power of the Great Northern, with headquarters at St. Paul, Minn., has been connected with that railroad for 29 years. He was born at St. Paul on July 26, 1877, and in 1901 was a graduate of the University of Minnesota. In the latter year he entered railway service as a mechanical draftsman in the employ of the Great Northern, later being advanced to an inspectorship. Mr. Wood was promoted to superintendent of shops at Barnesville, Minn., in 1905, being appointed superintendent of car shops at St. Paul in 1906. In 1910 he was advanced to engineer of tests, with headquarters at St. Paul, and five years later became mechanical valuation engineer, with headquarters at the same point. Early in 1917 he was promoted to mechanical engineer, with headquarters at St. Paul, a position he held until his promotion to assistant general superintendent of motive power.

William R. Wood

Master Mechanics and Road Foremen

R. P. LOUGHRY, traveling engineer of the Pennsylvania, Pittsburgh division, has been appointed assistant road foreman of engines of the Buffalo division.

F. C. CHARNOCK, special duty fireman of the Pennsylvania, Buffalo division, has been appointed assistant road foreman of engines of the Wheeling division.

F. R. HUSTED, assistant road foreman of engines of the Pennsylvania, Buffalo division, has been appointed assistant road foreman of engines of the Pittsburgh division.

C. E. PLOTT, has been appointed assistant master mechanic of the Galesburg and East Ottumwa division of the Chicago, Burlington & Quincy, with headquarters at Galesburg, Ill.

D. A. SMITH, acting assistant road foreman of engines of the Pennsylvania, Wheeling division, has been appointed assistant road foreman of engines of the Conemaugh division.

G. E. JOHNSON, master mechanic of the Wymore division of the Chicago, Burlington & Quincy, has been transferred to the Omaha division, with headquarters at Omaha, Neb.

J. S. FORD, master mechanic of the Omaha division of the Chicago, Burlington & Quincy at Omaha, Neb., has been transferred to the Centerville division, with headquarters at Centerville, Iowa.

THE JURISDICTION of J. Dietrich, master mechanic of the Lincoln division at Lincoln, Neb., has been extended to include the Wymore division. The position of master mechanic at Wymore, Neb., has been abolished.

(*Continued on next left-hand page*)

Car Department

T. G. VINCENT has been appointed car foreman of the Canadian National with headquarters at Sarnia, Ont.

W. HARE has been appointed car foreman of the Canadian National, with headquarters at Palmerston, Ont., succeeding J. H. Hosking, retired.

Shops and Enginehouse

PHILIP KOCH, foreman at the Camden, N. J., enginehouse of the Reading, has retired after thirty-three years' railroad service.

J. N. A. PELLETIER has been appointed acting assistant foreman of the erecting shop of the Canadian National at Riviere du Loup, Que.

ERNEST E. SMITH, a machinist in the employ of the Southern at Spencer, N. C., has been promoted to the position of assistant night enginehouse foreman.

J. M. A. BOURDEAU has been appointed acting night locomotive foreman of the Canadian National, with headquarters at Mont Joli, Que., succeeding J. B. Levesque, retired.

H. A. BOURDEAU, locomotive foreman of the Canadian National, has been appointed general foreman in charge both of the enginehouse and locomotive shops at Riviere du Loup, Que.

Purchasing and Stores

F. G. DRIELING has been appointed division storekeeper of the Northern Pacific, with headquarters at St. Paul, Minn.

J. E. CANDELAS, assistant general purchasing agent of the National of Mexico, has been appointed superintendent of stores, with headquarters as before at Mexico, D. F.

Obituary

CHARLES ROGERS CRAIG, formerly general purchasing agent of the Southern, died at his home at Washington, D. C., on January 5, at the age of 58 years.

PETER HOWATT, division storekeeper of the Atchison, Topeka & Santa Fe at Corwith, Ill., for the past 25 years, died recently from injuries received in an automobile accident.

WALTER BYRD, who was master mechanic of the Esquimalt & Manaimo, with headquarters at Wellington, B. C., from 1918 until his retirement in 1928, died at Victoria, B. C., on December 1 at the age of 70 years.

JAMES W. GIBBONS, general foreman of the passenger car department in the shops of the Atchison, Topeka & Santa Fe at Topeka, Kan., died recently at the Santa Fe hospital in that city at the age of 65 years. Mr. Gibbons was for many years active in the affairs of the Master Car and Locomotive Painters Association of the United States and Canada and was a past chairman of that organization, which is now the Equipment Painting Section of the American Railway Association.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

ANGLE-STEEL AND SHEET-METAL EQUIPMENT.—Catalog M-S 1931, descriptive of angle-steel and sheet-metal equipment for factory, shop and office use, is being distributed by the Angle Steel Stool Company, Plainwell, Mich. The catalog is 8½ in. by 11 in. in size and contains 32 pages.

WELDING ACCESSORIES.—A complete line of electric arc welding accessories and supplies is illustrated and described and prices given in the 12-page catalog issued by the Fusion Welding Corporation, One Hundred Third street and Torrence avenue, Chicago.

BUFFALO BILLET SHEARS AND BAR CUTTERS.—Four types of shears for cutting bars and other shapes are shown in Bulletin No. 330, issued by the Buffalo Forge Company, Buffalo, N. Y. The machines cut a wide variety of bars and shapes and the electrically welded frames are built of Armor-Plate steel.

PLANER MOTORS.—Type T heavy-duty Reliance planer motors for reversing service are described in Bulletin No. 207 issued by the Reliance Electric & Engineering Company, Cleveland, Ohio. The direct-connected reversing motor eliminates belts and the desired cutting speed can be maintained regardless of changing conditions.

LINK-BELT P. I. V. GEAR.—A 16-page book, No. 1274, issued by the Link-Belt Company, 910 South Michigan avenue, Chicago, describes the new P. I. V. Gear, an all-metal variable speed transmission. Two double-page spreads illustrate the features of the unit, such as the side-tooth chain operating in contact with the toothed discs.

STATIC TESTING MACHINE.—The Waugh Equipment Company, New York, has issued a 12-page pamphlet describing the million-pound static testing machine which is a part of the Waugh-Gould testing laboratories. The machine, which is hydraulically operated and is capable of exerting a pressure of one million pounds, has an overall height of 37 ft. It is adapted for all forms of tension, compression and transverse testing. The pamphlet contains a description of the machine, its operation and the accurate instruments provided for indicating the load and travel in draft gear tests.

LUDLUM STEEL.—A catalogue attractively and conveniently bound in sectional form has been issued by the Ludlum Steel Company, Watervliet, N. Y. The binder, in which three sections are now assembled, is provided with additional wire fastenings for embodying other Ludlum catalogue or printed material issued from time to time. Two of the sections now included in the binder discuss high-speed carbon and alloy tool steels, corrosion, heat and wear-resisting steels, valve steel and Strauss metal, and high speed, special alloy, carbon and special-purpose tool steels. The third section is a reference book of steel-treating tabulations.

LANDIS MACHINES.—The Landis Machine Company, Waynesboro, Pa., has issued a number of new bulletins as follows: C-61, Landis 6-in. and 8-in. pipe threading and cutting machines; C-63, Landis stationary pipe, casing, drill pipe, line pipe and tubing die heads; D-65, Landis ¼-in. and 2-in. pipe and nipple threading machine, E-70, Landis ¾-in. and 1-in. automatic forming and threading machines; F-71, Landmatic heads for turret lathes and screw machines; F-72, Landex heads for automatic screw machines; G-73, Victor collapsible and solid adjustable taps; G-74, Victor receding chaser and collapsible taps, and H-76, Lanco heads for automatic, semi-automatic and hand-operated machines.

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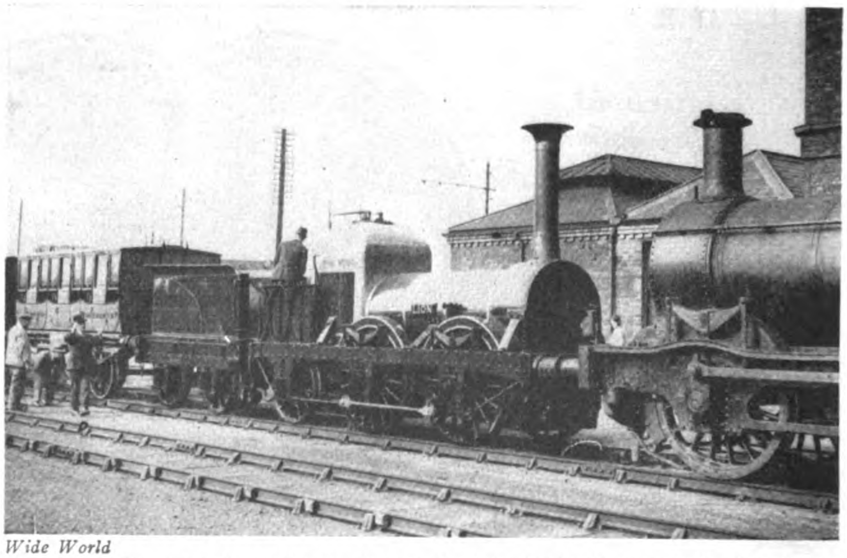

Wide World

Replicas of one of the early coaches and of the "Lion," one of the first locomotives used in regular service on the Liverpool & Manchester, as prepared for exhibition at the British Railway Centenary

Railway Mechanical Engineer

Founded in 1832 as the American Rail-Road Journal
With which are also incorporated the National Car Builder, American Engineer and Railroad Journal, and Railway Master Mechanic. Name Registered, U. S. Patent Office

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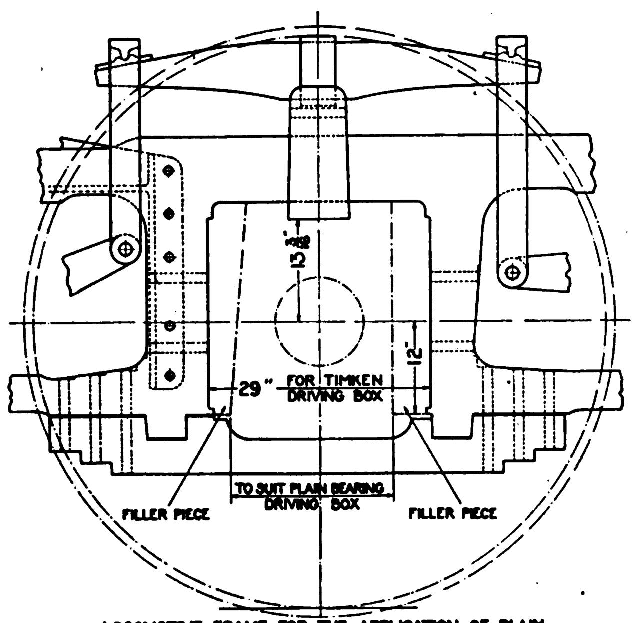


LOCOMOTIVE FRAME FOR THE APPLICATION OF PLAIN BEARING OR TIMKEN ROLLER BEARING DRIVING BOXES

Look to the future

The Roller Bearing Locomotive is a proved success. Design the main frames of your new engines for future Timken Bearing applications

In a few years no locomotive will be considered modern unless it is completely Timken Bearing Equipped, for the performance of the Timken roller bearing locomotive has revealed operating efficiencies and economies that no railroad can afford to ignore.

The Timken locomotive has now gone more than 60,000 miles in fast passenger and freight test service without any bearing difficulty whatsoever.

This showing would justify the immediate adoption of Timken Bearings for all locomotive driving axles, but in any case it points to the wisdom of designing your new locomotives so that Timken Bearing axles can be quickly and economically substituted for the plain bearing driving axles when the time is ripe.

All that is necessary is a slight modification in the design of the frames as shown by the accompanying drawing, mainly involving the provision of larger openings for the axles.

Removable filler blocks or thicker shoes and wedges will permit the use of Timken or plain bearing axles at will.

Protect your new locomotives against the threat of early obsolescence by incorporating this feature. The Timken Roller Bearing Company, Canton, Ohio.

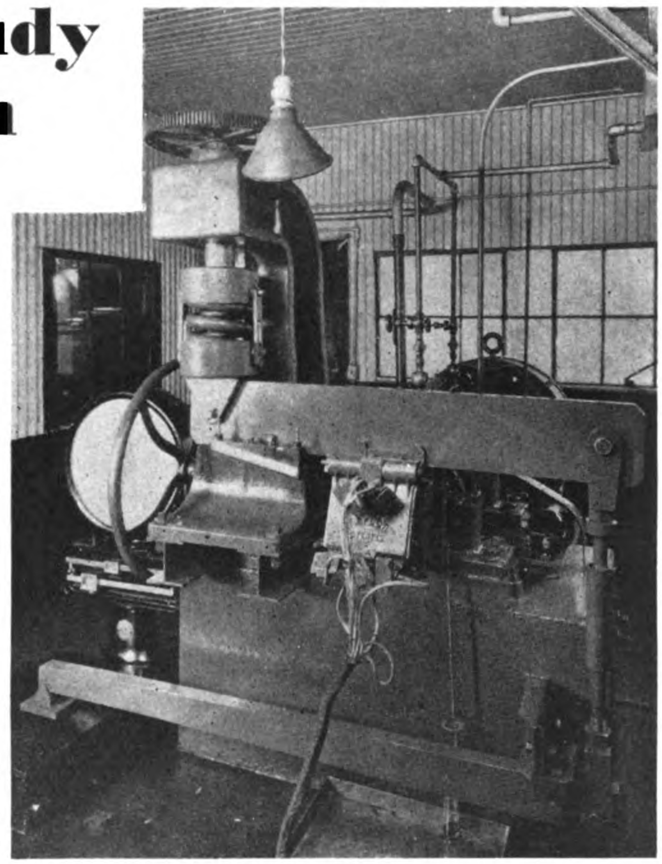
TIMKEN *Tapered Roller* **BEARINGS**

Railway
Mechanical Engineer

Founded in 1832 as the American Rail-Road Journal

March - 1931

A Test Plant To Study Journal Operation



Front of the machine from the right, showing speed-indicating generator, journal box and pyrometer leads, and the end-leakage measuring device

Description and potentialities of equipment designed to analyze and indicate improvements in journal bearings

THE railroad car journal bearing and its correlated parts exist in greater duplication of units than any other part of rolling stock construction. There are at least 16,000,000 on the railroads in the United States. This number of units is standardized to as great a degree as any other part of the equipment under which they operate. That the present journal bearing and its correlated parts has given an apparent great measure of service in the past is evidenced by the fact that it has remained practically unchanged in the steady advances in mechanical development that have been in process at an accelerated rate in the past decade.

The present day demand for higher speeds under heavier loads over ever increasing operating periods of time has intensified the demand that journal performance must improve or become an ever-increasing factor in retarding economic operation and nullifying the money and effort already invested in improvements in equipment, materials, and facilities.

The railroad car journal assembly is a very simple mechanical construction. To date little is known of the fundamentals upon which its positive successful operation depends.

The first fact evident in a constructive analysis, for the purpose of finding a starting point for improvement, is that there is no base line from which to measure the performance so far obtained or to measure the degree to which performance can be improved; nor the economics of such improvements as are developed. It is further evident that guess work has been all too prevalent in the past and is too expensive for the future.

There being available little or no data of a technical nature, it is evident that the first step in any advancement of the art is to provide adequate means of observing and collecting data representative of operating conditions. It is also necessary to have means of measuring the nature and the degree to which various conditions of bearing construction, lubrication, and operation affect the performance as a whole and the degree to which they augment or detract from the performance of each other.

In order to collect this basic data and to provide means whereby the way to improvement can be charted, and the economic value of the improvement after it is accomplished be measured, the journal testing plant described in this article was put in operation some six months ago by the Railway Service & Supply Company, Indianapolis, Ind., after a long period of research and design.

Description of the Friction Machine

Briefly, the plant consists of a machine using a standard A.R.A. 5½-in. by 10-in. journal, brass, wedge, and box, or in other words the standard construction in general use on one end of a standard A.R.A. axle. This

axle is supported in two large roller bearings, flood lubricated, with the oil stream passing through a cooling system by forced circulation. At the end of the axle opposite the test journal is connected a specially built calibrated motor of ample size to start under any conditions of load up to 30,000 lb. per journal, operate at any rate of speed and at any rate of acceleration. The load is applied to the top of the journal box in the same manner as applied in actual service; that is through an equalizer coil spring and suitable lever arms balancing the load to the platform of an indicating scale. In this manner the load can be varied to any degree at any time and is accurately measured. By virtue of the calibrated motor driving the axle, there is recorded directly the reading of frictional horsepower, which is the measure of all lubricating effect. Speed in miles per hour is recorded in such a manner that the chart of speed in miles per hour and horsepower are directly comparable. Instruments for this purpose are shown in one of the illustrations. Temperatures in three locations in the journal bearing and three or more locations in the journal-box packing under the bearing are indicated by suitable pyrometer equipment. Oil end leakage from the journal and back of the box is measured by suitable connections to the journal box. The effect of windage upon the operation is produced by suitable blast fans directing currents of air against the box at proper velocities. The entire journal testing machine is in a separate room from the operating and recording equipment, permitting the operation of the machine at varying temperatures. The mechanism for the operation and control of the equipment is shown in another of the illustrations.

One great criticism of all efforts in the past in determining the mechanical effect of friction has been that the equipment so used gave the results in comparative figures only and not in their direct economic significance. The effort here has been to spell friction directly in terms of horsepower and not in terms of a coefficient. That this equipment has accomplished this purpose and is able to reproduce results or run check tests is evidenced by the following tabulation of two separate runs under identical conditions, the comparison being in the readings of horsepower-hours per mile per journal.

With this test equipment can also be established the reliability of any specific element of the journal oper-

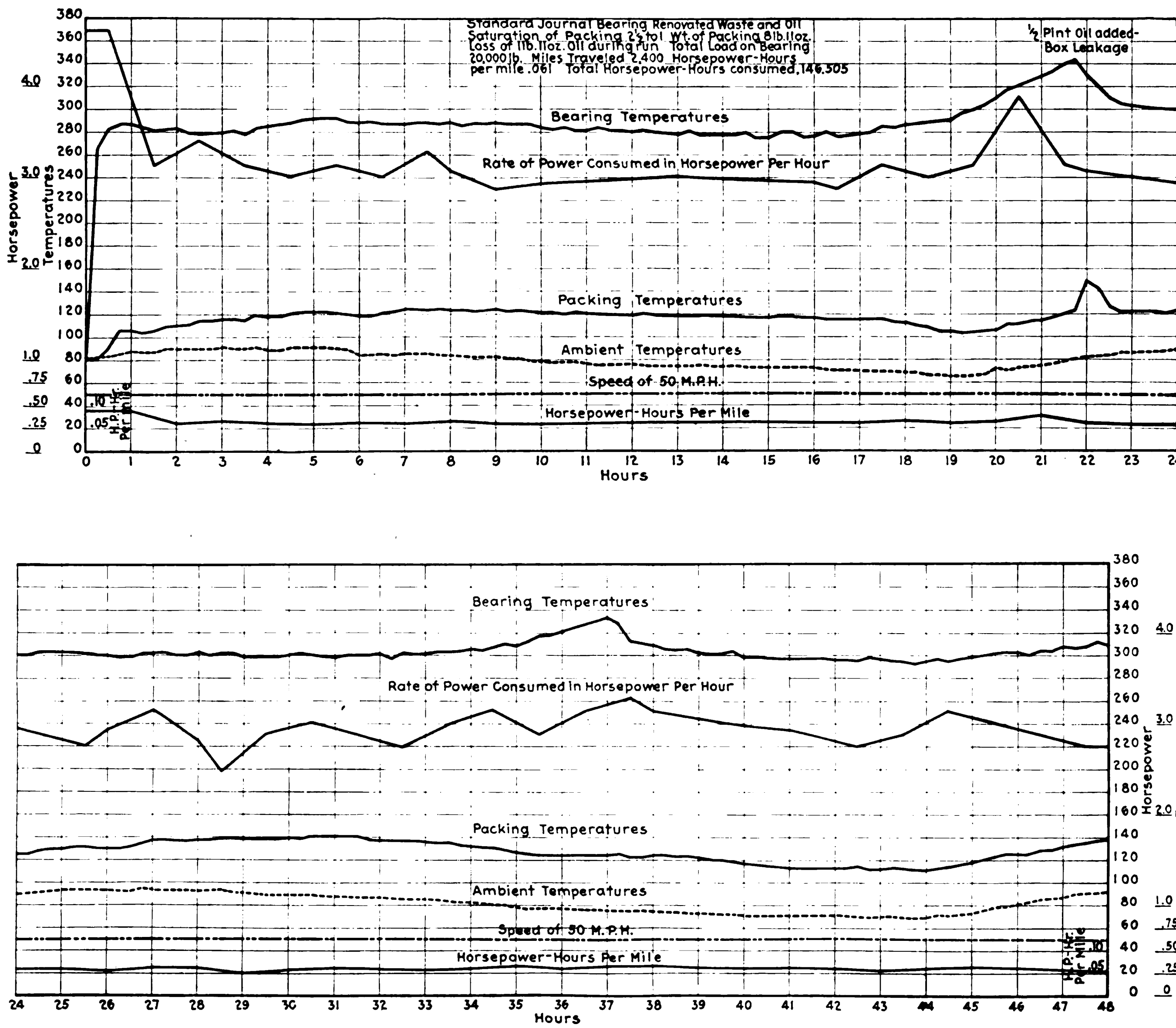
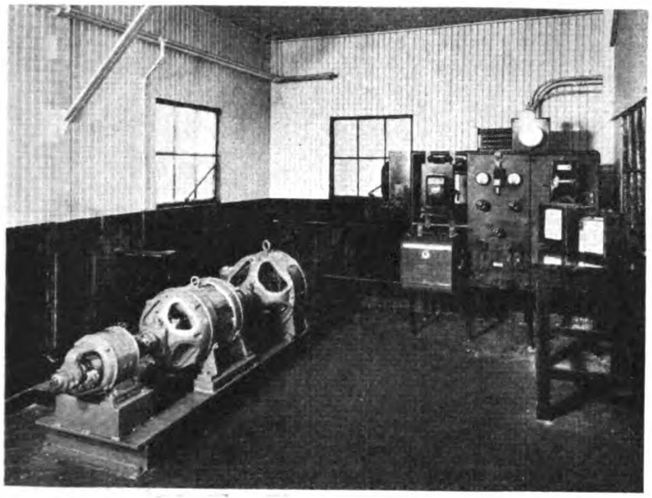


Chart record of a 48-hr. full-load test run

M.P.H.	Miles traveled	Total hp.-hr.	Hp.-hr. per mile	Brass temp.	Amp. temp.
		TEST A—RUN NO. 1			
15	3.75	.2237	.059	168	71
20	5.00	.2800	.056	164	72
30	7.50	.4452	.059	168	73
40	10.00	.6078	.061	183	74
50	12.50	.7309	.058	200	76
60	15.00	.8675	.058	220	77
70	17.50	.8791	.050	240	78
		TEST A—RUN NO. 2			
15	3.75	.2104	.056	178	71
20	5.00	.2401	.048	178	72
30	7.50	.4452	.059	182	74
40	10.00	.5280	.053	200	73
50	12.50	.6112	.049	211	74
60	15.00	.7478	.050	232	74
70	17.50	.8525	.049	250	76

Total load, 20,000 lb.; Effective bearing area, 24.8 sq. in.; Lb. per sq. in. of bearing area, 806.

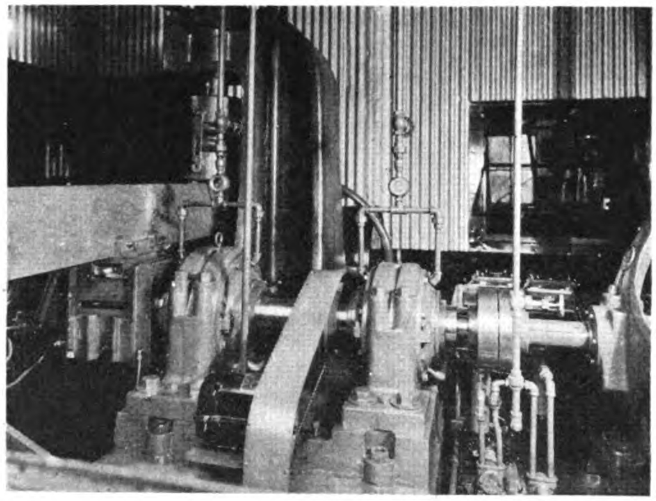
ation as shown by the chart, in which a journal box packed with renovated oil and waste was operated under a load of 20,000 lb. at a speed of 50 m.p.h. for 48 hours without stopping. This is equivalent to the



Control equipment, showing speed-regulating board with recording instruments for horsepower consumption and speed in miles per hour

journal condition under a car of 80 tons spring suspended weight with eight journals operated at 50 m.p.h. for a distance of 2,400 miles. It would be impossible to reproduce this condition in service, the purpose being to indicate the stability of performance that can be expected from a standard A.R.A. journal box assembly and that in the observation of such a run the phenomena of journal lubrication is available for observation and analysis in a manner not possible under any other conditions. It is the purpose in the operation of this test plant first to observe all the operating phenomena of the journal, brass, wedge, waste and oil as they now occur; then by changing one element at a time, improve the performance to the highest degree to which that one element can attain. When all the elements have been so analyzed, the final problem is one of their combination and the establishment of the results to be obtained by their cumulative improvement.

Investigation is to be made as to the degree of saturation of journal-box packing and the effect of this degree of saturation upon the immediate and prolonged service of a journal. The mechanical practices as they pertain to the methods of packing boxes and the degree to which certain practices in packing boxes augment or detract from satisfactory performance are to be investigated. To whatever degree they may contribute to more satisfactory operation, a knowledge of the effect of load, speed, time, and temperature and their relation to each other are to be determined.

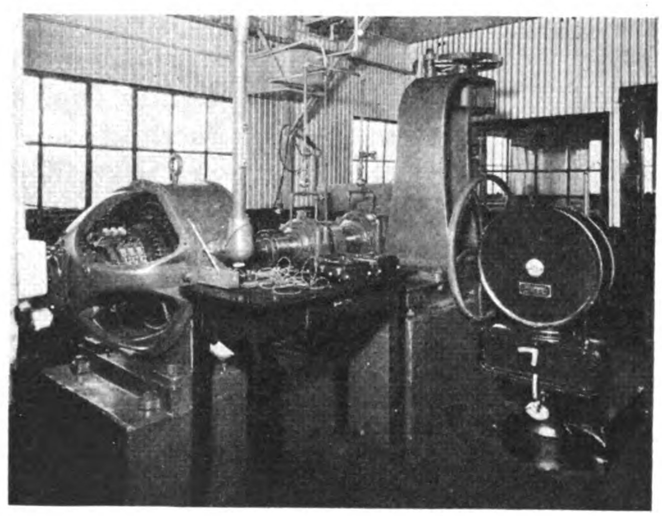


Right side of the machine, showing the axle and supporting roller bearings with oil circulating pump and lines, speed-recorder connection and axle coupled to the motor at the right

From all of the above data, there is constructively the next to the last step; namely, the analyzing of the construction of the journal bearing, both as it involves the materials used and such features as clearance, bearing area, broaching, and prevention of end leakage; investigation of which conditions has already indicated that without affecting the interchangeability of the present journal bearing, certain changes can be made which will prolong the life of the bearing and possibly reduce to a minimum, if not entirely eliminate, the possibility of waste grabs, which are one of the principal results of or causes for hot boxes.

As a final step in the investigation, the construction of journal boxes as they may have a bearing on the economic use or conservation of materials with which the journal box is packed and upon the performance of the journal is to be established.

Pilot tests of the above elements, which have been made during the last six months, have indicated that the cumulative effect of available improvements and the various elements influencing performance as above indicated, would produce a vast improvement in the performance of the present journal and its adjacent parts, and do this for less money than is now being expended.



The machine from the left rear, showing the direct-connected driving motor and calibration instruments for the motor

Stug 2-10-0 type locomotive in freight service on the German State Railways

Stug System of Firing Pulverized Fuel

By R. Roosen

A report of the system being developed for firing pulverized fuel by the "Stug," an association of German locomotive builders which is sponsoring research in the utilization of low-grade fuels for firing locomotives—Test results with lignite fuel are given and the methods and equipment used are described—Part I

FOLLOWING is an abstract of a paper by R. Roosen, chief engineer in charge of the research department, Henschel & Sohn A. G., Kassel, Germany, entitled "The Stug System of Pulverized-Fuel Firing on Locomotives." This paper was contributed by the Railroad Division at the annual meeting of the American Society of Mechanical Engineers, which was held December 1 to 5, 1930, in the Engineering Societies' Building, New York. In addition to his activities as chief engineer for Henschel & Sohn, Mr. Roosen is in charge of the research work for the Studiengesellschaft für Kohlenstaubfeuerung auf Lokomotiven, commonly known as the "Stug," an association of German locomotive builders, and coal and lignite syndicates which was formed to study the utilization of low-grade fuel for firing locomotives. The Stug includes the following firms: A. Borsig, G.m.b.H., Berlin-Tegel; Hanomag, Hannover-Linden; Henschel & Sohn A. G., Kassel; Fried. Krupp A. G., Essen (Ruhr), and Berliner Maschinenbau A. G., vorm. L. Schwartzkopff, Berlin, as well as the German coal and lignite syndicates: Mitteldeutsches Braunkohlensyndikat, Leipzig; Ostelbisches Braunkohlensyndikat, Berlin; Rheinisches Braunkohlensyndikat, Köln am Rhein; Rheinisch-Westfälisches Kohlensyndikat, Essen (Ruhr), and Oberschlesisches Steinkohlen-Syndikat, Gleiwitz.

These are in cooperation with the German State Railways, the offices being at Kassel on the premises of Henschel & Sohn A. G., where the study and research work were carried out.

The abstract of Mr. Roosen's paper follows.

The numerous advantages which pulverized-fuel firing had given in stationary plants strongly suggested its extension to locomotives, considering that a number of advantages in railway operation and economics were to be expected. Among those aimed at, the following are particularly worthy of mention:

1.—Cutting down the fuel bill, which result is achieved by the possibility of using low-grade, cheap fuel, particularly such as would not be suitable for grate firing; reducing the quantity of fuel consumed, as pulverized-fuel firing permits of controlling the fire according to the actual output of the locomotive; reduction of standby losses to a minimum and thus avoiding blowing off of safety valves, and better utilization of fuel, owing to improved boiler efficiency.

2.—Savings in the enginehouse, owing to considerably reduced wage bill for cleaning ashpan, smokebox, and pits.

3.—Quicker readiness for service, as boiler will be steamed in considerably less time.

4.—No obstructions to draft by clinker as on the grate of standard engines, and consequently increased locomotive mileage.

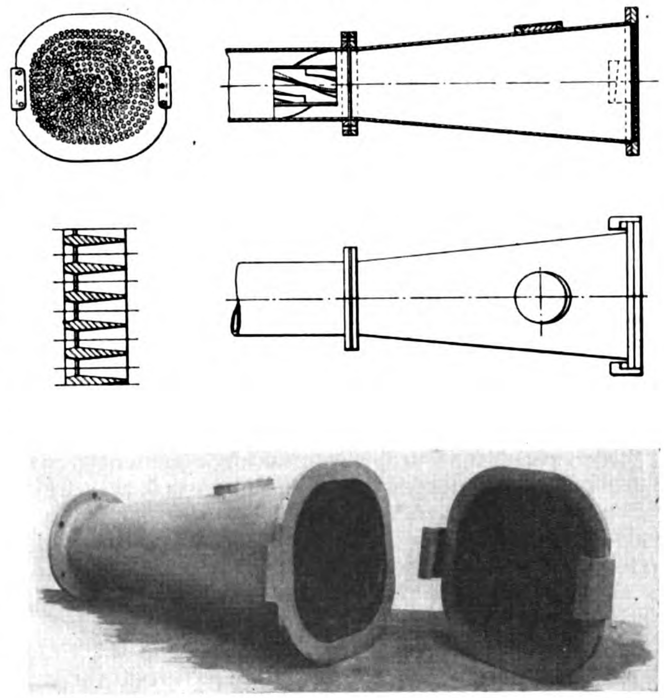
5.—Possibility of firing large quantities of fuel in a more economical way than with any other type of mechanical stoking: fireman fatigue completely eliminated.

6.—No sparking at all, avoiding danger of conflagration; no smoke annoyance.'

These advantages have instigated considerable experimenting with a view to applying pulverized-fuel firing to locomotives. The attempts made in the United States and elsewhere, such as in Brazil, Sweden, and England, are too well known to need a résumé. In all these cases, however, difficulties more or less prevented the adoption of pulverized-fuel firing on a large scale. Such difficulties were due to the fact that locomotive boilers with their small furnaces present less favorable conditions than stationary boilers or furnaces. In order to ensure sufficient steaming, the locomotive furnace must be forced to about 10 times the volumetric rate of heat release that is usual in stationary plants. Either the requisite firebox output was not attained or the result was the formation of slag on the tube sheet, which soon caused a decrease in steam generation. This may have been due to the fact that stationary-boiler practice with pulverized-fuel firing was applied to locomotive boilers without due consideration being given to their peculiar conditions of service. Either the types of burners employed or the method of supplying air did not prove suitable for generating in the relatively small firebox the amount of heat necessary to develop the requisite quantity of steam or to ensure combustion under such conditions as would preclude trouble with the slag. Any departure from the normal firebox, however, was not advisable, because it was important, in order to introduce pulverized-fuel firing without considerable initial cost, to abide by the approved pattern, with a view to the easy conversion of existing locomotives into dust-fired engines.

Moreover, the form of the firebox brick lining, which was deemed necessary in a too close imitation of stationary practice, was a delicate problem. The high temperatures in the firebox resulting from excessive lining, combined with the action of the long, sharp pin flames produced by the types of burners employed, caused a progressive destruction of the brickwork. The complicated design of the lining also made it apt to crumble and break down under the influence of running shocks. All this entailed continuous and expensive repair work.

Another problem to be faced was the limited space on



New design of Stug pulverized-fuel burner for locomotives

the locomotive and tender available for the pulverized-fuel equipment, which of course must be arranged so as to combine reliability with economy.

The aforementioned difficulties made pulverized-fuel firing on locomotives a difficult problem with which to cope. On the other hand, there was sufficient incitement to tackle it anew and bring about definitely satisfactory results. It was with this object in mind that the Stug was formed when after the war economical considerations in Germany urged the use of low-grade fuel for locomotive firing, particularly lignite, which was available in abundance. The experiments were to evolve a system which would combine the following features: A rate of evaporation of 12.3 lb. of steam per square foot of heating surface per hour; variation of burner

Table I—Tests Made in the Rothenditmold Testing Plant on Lignite Fuel

Date	6-24-25	6-24-25	6-5-25	6-23-25
Test No.	76	76	72	74
Lower heating value, B.t.u. per lb.	9,360	9,360	9,360	9,360
Fuel consumption, lb. per hour	1,850	2,290	2,625	3,260
Firebox heat output, B.t.u. per cu. ft. per hour	1.2×10^5	1.48×10^5	1.69×10^5	2.1×10^5
Evaporation, lb. per hour	9,060	11,080	12,100	14,350
Temperature of feedwater, deg. F.	51.8	51.8	51.8	51.8
Coefficient of evaporation	4.88	4.83	4.61	4.38
Evaporation of heating surface, lb. per sq. ft. per hour	9.35	11.42	12.50	14.80
Boiler pressure, lb. per sq. in.	85.3	85.3	85.3	85.3
Average temperature of superheated steam, deg. F.	742	726	689	698
Average temperature of flue gas in smokebox, deg. F.	738	706	698	717
Analysis of flue gas: CO_2, per cent	15.6	15.6	14.9	14.2
Analysis of flue gas: O_2, per cent	.....	.....	.....	.....
Analysis of flue gas: CO, per cent	.....	.....	.....	.....
Boiler efficiency, determined from flue-gas losses, per cent	71.7	73.1	72.5	71.3

Free heating surface in firebox (not brick-lined), sq. ft.	100.3
Heating surface in tubes, sq. ft.	867.4
Total heating surface, sq. ft.	967.7
Firebox capacity, cu. ft.	144.7

$$\frac{\text{Free heating surface in firebox (sq. ft.)}}{\text{total heating surface (sq. ft.)}} \ldots \frac{100.3}{967.7} = \frac{1}{9.65}$$

$$\frac{\text{Firebox capacity (cu. ft.)}}{\text{total heating surface (sq. ft.)}} \ldots \frac{144.7}{967.7} = \frac{1}{6.68}$$

output within the wide range between maximum and minimum rates; high boiler efficiency and prevention of honeycombing so as to ensure continuous operation without trouble due to slag deposits; simple and highly resistive brick lining, and utmost working reliability of the whole equipment.

The work was systematically carried out on the largest possible scale, since there was a clear understanding that real success could be attained only by making a sound combination of theoretical investigation and experimental work.

In order to avoid from the inception the shortcomings of earlier experiments, two principal requirements had to be fulfilled in the first place:

1.—Shaping the flame so as to fill the whole firebox and avoiding the pin flames which deteriorate the tube sheet or brick lining.

2.—Obtaining a high specific intensity of combustion for peak loads of about 230,000 B.t.u. per cu. ft. of firebox volume, and even more in particular cases, i.e., about 10 times the amount obtained in stationary plants.

Experimentation, properly speaking, commenced after thorough preparatory work. The main task was to develop a type of burner suitable for the combustion of pulverized fuel in a locomotive firebox. The result was, after some simplifications of the shape, a burner such as is shown in one of the illustrations, which shows the definite form. This burner, on account of its action, is called a "spray burner," and it is based on the Stug's principle of subdividing the injected mixture to the largest possible extent. It consists essentially of a truncated hollow cone, the front end of which is closed by a plate having a large number of nozzle-shaped holes, whereas the small rear end joins a mixing device for the coal dust and air mixture entering at this point. The dust and air mixture is thus spread into a considerable number of individual jets which are ignited almost immediately in front of the burner plate, and this causes the formation of a diffused, ball-shaped flame.

Clogging of the numerous holes by dust was never experienced. The burner or burners, which are thus constructed in a simple manner, are so arranged that the spray plates come nearly flush with the firebox back plate, while the burner bodies are outside. The burner bodies therefore remain cold when in operation; the spray plate, which is exposed to radiating heat, being cooled by the coal dust and air mixture. Special cooling of the burners can thus be dispensed with. If one of the burners is out of operation, it is cooled during that time by a small current of pure air.

In order to achieve correct design of the burner and furnace, a large number of questions had to be studied, such as the process of combustion, the intensity of combustion, influence of the shape and dimensions of the brick lining on combustion, etc. Thus, the intensity of combustion, expressed in thermal units per cubic foot of firebox volume, is inversely proportional to the gas volume developed during the time of combustion of the dust. The latter must not remain in the firebox for less time than it takes for complete combustion, and the gas speed in the firebox, therefore, must not exceed the velocity of combustion of a dust grain. The gas volume developed during the time of combustion must consequently remain in the firebox until combustion of the dust grain is completed. The gas volume, however, increases with increasing temperature, i.e., lowering the temperature would permit of increasing the intensity of combustion, and this can be effected by reducing the brick lining.

Shortening the combustion period of the dust grain has the same effect. It can be obtained, besides, by proper mixture of the dust and air in the burners, as mentioned before, by increasing the fineness of milling of the coal. This process, however, if pushed beyond commercial practice, may become uneconomical, so that the use of this method is curtailed. Thus the Stug uses a degree of fineness of about 15 to 25 per cent residues on a 170-mesh sieve for lignite and about 10 to 20 per cent for coal containing a low percentage of volatiles.

Table II—Tests Made in the Mittelfeld Testing Plant on Lignite Fuel

Date	3 22 28	4 24-28	6-26-28	5-18-28	11-11-27	11-11-27
Test No.	343	354	379	362	283	284
Lower heating value, B.t.u. per lb.	10,060	8,950	8,500	9,420	8,725	8,725
Fuel consumption, lb. per hour	4,380	5,390	6,080	6,180	7,680	8,500
Firebox heat output, B.t.u. per cu. ft. per hour	1.98×10^5	2.17×10^5	2.32×10^5	2.61×10^5	3.10×10^5	3.33×10^5
Evaporation, lb. per hour	26,150	29,600	30,620	34,200	36,960	40,500
Temperature of feedwater, deg. F.	212	212	206	210	212	212
Coefficient of evaporation	5.96	5.50	5.03	5.53	4.82	4.77
Evaporation of heating surface, lb. per sq. ft. per hour	12.52	14.18	14.70	16.40	17.70	19.40
Boiler pressure, lb. per sq. in.	170.7	170.7	167.8	170.7	163.6	169.4
Average temperature of superheated steam, deg. F.	770	689	768	711	644	655
Average temperature of flue gas in smokebox, deg. F.	635	646	638	696	882	912
Analysis of **flue gas**: CO_2, per cent	14.7	15.1	14.85	14.3	13.5	13.1
Analysis of **flue gas**: O_2, per cent	2.65	3.1	2.0	2.6	5.0	4.8
Analysis of **flue gas**: CO, per cent	0.25	0.40	0.20	0.33	......	......
Boiler efficiency, determined from flue-gas losses, per cent	73.0	72.9	73,25	70.8	66.2	64.7
Free heating surface in firebox (not brick-lined), sq. ft.						139.9
Heating surface in tubes, sq. ft.						1945.1
Total heating surface, sq. ft.						2085.0
Firebox capacity, cu. ft.						222.5

$$\frac{\text{Free heating surface in firebox (sq. ft.)}}{\text{total heating surface (sq. ft.)}} = \frac{139.9}{2085.0} = \frac{1}{14.9}$$

$$\frac{\text{(Firebox capacity (cu. ft.)}}{\text{total heating surface (sq. ft.)}} = \frac{222.5}{2085.0} = \frac{1}{9.36}$$

All this investigation work required a large number of tests. Under these conditions the Stug obtained, as early as 1925, in a locomotive boiler of 967.7 sq. ft. heating surface, an evaporation from cold feedwater of 14.3 lb. of steam per square foot of heating surface, combustion being entirely satisfactory (see Table I).

When the German State Railways, on the strength of these results, called upon the Stug to obtain a rate of evaporation of 12.3 lb. of steam per square foot of heating surface per hour in the G-12 class locomotive boiler, the desired result was obtained only after further experimental work. The difficulty was that this boiler has a firebox considerably smaller in relation to the heating surface than the boiler tested in the first place (ratio 1 to 9.65 as against 1 to 14.9). It thus became necessary to raise the intensity of combustion to more than 237,000 B.t.u. per cu. ft. per hour. The brick lining was ac-

tually reduced to a minimum, and was just sufficient for the heat from the incandescent lining below the brick arch to be radiated back to the burner, and to protect the casing which has taken the place of the ashpan. Under these conditions the Stug even succeeded in intermittently raising the intensity to about 316,000 B.t.u. per cu. ft. per hour and the steam generation to well above 20.5 lb. per sq. ft. of heating surface per hour, which result, to the author's knowledge, has never been equaled by any other type of stoking on locomotives (see Table II). Indeed, this is more than a locomotive boiler would continuously stand. On analysis the flue gases were found to contain 13.5 per cent carbon dioxide and 5 per cent oxygen. The smoke emitted from the chimney was transparent and showed a grayish hue. The fuel was a commercial quality of lignite dust developing about 9,000 B.t.u. per lb. when ground to about 20 per cent residue on a 170-mesh screen.

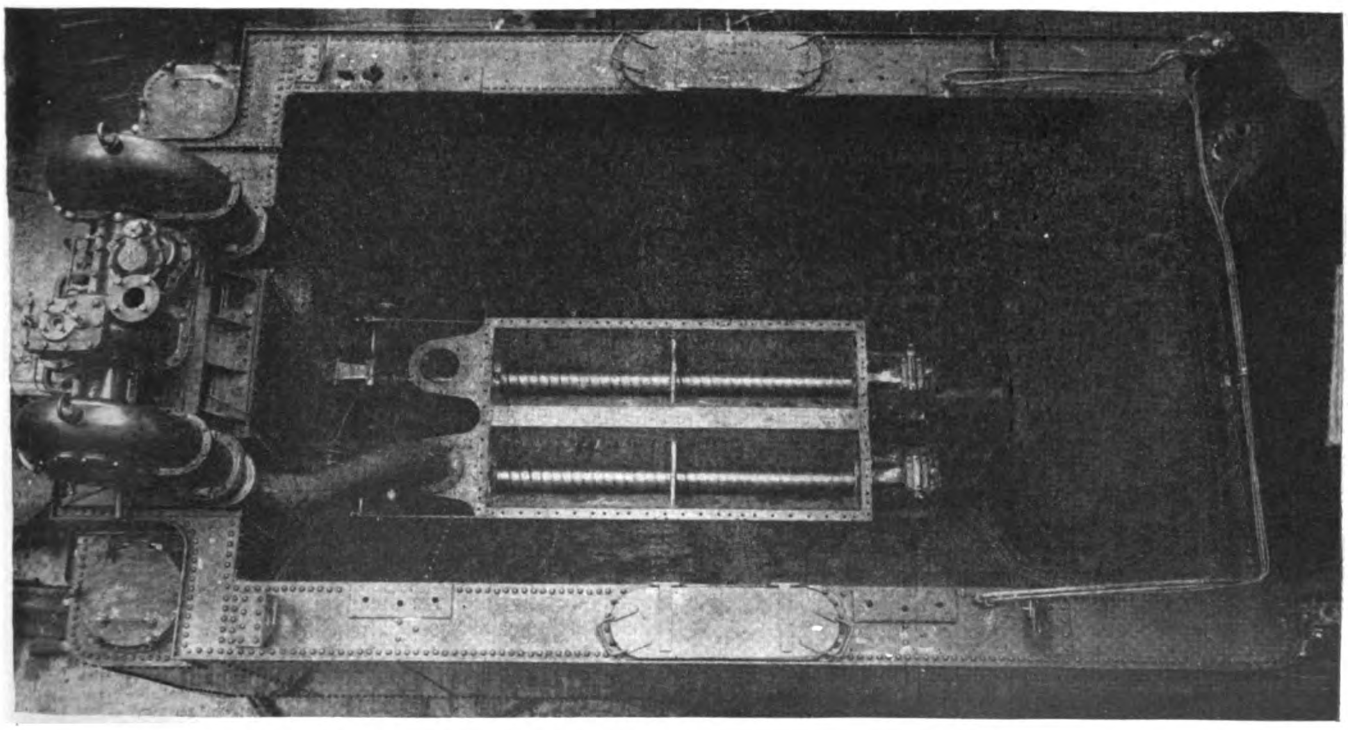
After these excellent results were obtained, the German State Railways placed an order with Henschel & Sohn, one of the members of the Stug, to fit a coal-dust burning apparatus on two heavy 2-10-0 type superheated freight locomotives of the G-12 class. These locomotives are of three-cylinder design with a heating surface of 2,100 sq. ft. and a grate area of 42.0 sq. ft. The tender is of the six wheel type and, when converted, retained the existing frame. Two burners of the type previously described are arranged below the firebox back plate, the spray plate having about 1,900 holes and allowing the passage of about 3,300 lb. per burner per hour. The ashpan is replaced by a casing suspended from the foundation ring. This casing is lined all over with firebrick, which radiate the heat stored in them back to the burners and thus assist in igniting the coal dust and air mixture. The brick lining of the wall opposite to the burners, below the brick arch, serves the same purpose. Apart from this, the firebox walls, nearly down to the foundation ring, are without any lining. This arrangement makes the whole of the surface in contact with the water highly evaporative and further affords easy observation of the staybolts. In the bottom of the casting a small auxiliary burner is provided, the operation of which is independent from the main burners. The front part of the casing is fitted with a bottom slide, operated from the fireman's side of the cab. Apart from this, the locomotives have not undergone any noteworthy modifications.

The tender tank, of 3,740 gal. capacity, is of the water-leg type. The usual coal bunker is replaced by the pulverized-fuel reservoir having a capacity of about 6.4 tons and is constructed as a closed container with sloping sides. This shape is preferable to a cylindrical container, because it makes for a steady flow of the coal dust and does not allow it to rest in the lower portion of the container. For the same reason the container is welded and not riveted, so as to avoid projecting edges. In addition, stirring nozzles are provided in the container sides. The container is supported on the water tank at four points, and can easily be lifted as a unit. It is provided with three filling apertures in the top, which also afford access for occasional inspection. As a rule, one of these openings is sufficient for filling purposes.

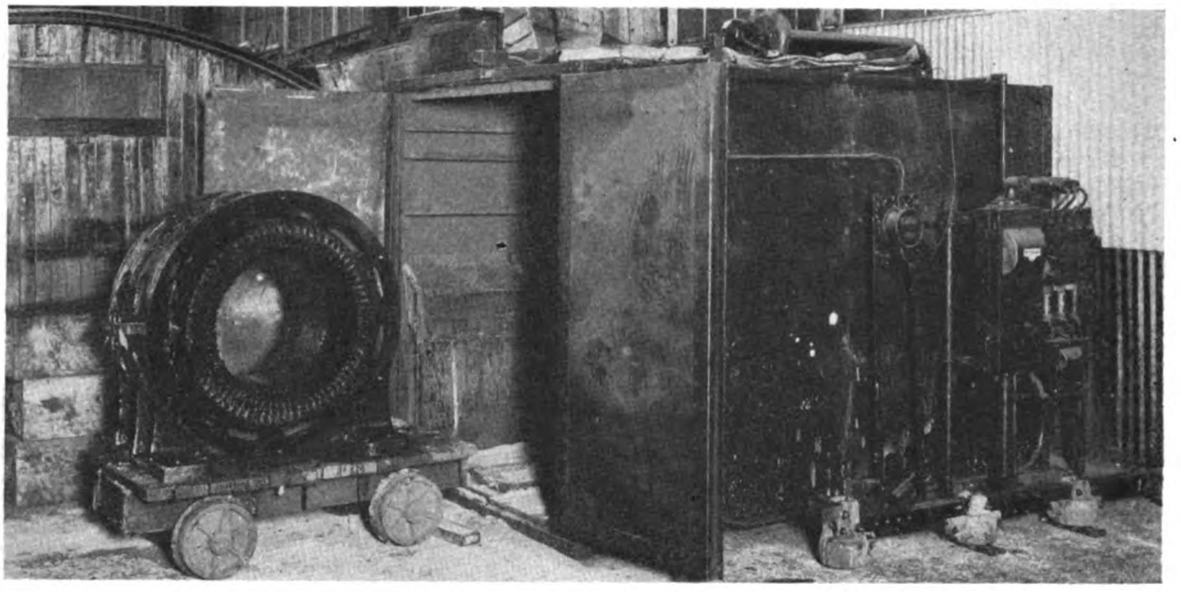
At the base of the container are three trough-shaped feedways, those on the outside housing the conveyor worms for the two main burners, while the conveyor screw for the auxiliary burner is lodged in the small central trough. These worms convey the coal dust toward an opening, through which it pours down into the air stream from the blowers. These worms can be clutched and declutched separately.

At the rear end of the water tank is the blower which supplies the air for combustion, and it should be noted that in this first lot of locomotives all of the air necessary for combustion is furnished by the blowers. This method keeps the excess of air in the firebox down to a minimum and ensures maximum boiler efficiency. The blowers are coupled to the turbine shaft, which revolves at a maximum speed of 4,500 r.p.m. and operates on saturated steam taken from the dome of the boiler. From the blower the air flows through two separate

(Concluded on page 134)



The tender tank showing the blowers and bottom of the pulverized-fuel bunker



A 300-hp. stator, impregnated with an insulating varnish, about to be placed in the armature-baking oven

Industrial Electric Heating For Railway Shops*

By Wirt S. Scott†

A study of operating costs of electrical-heating equipment installed in the Norfolk & Western shops at Roanoke, Va., and savings effected by its use

BECAUSE comparatively little was known until recently of the steam-railway industry's attitude towards the use of electricity for heat treating, a study was made to determine the economic value of electrically-heated equipment installed in Norfolk & Western Shops at Roanoke, Va. In the foregoing part of this article, which appeared in the February issue of the *Railway Mechanical Engineer,* a study was made of electrically-heated furnaces for heat-treating tool steel, for carburizing locomotive parts and for annealing steel castings, comparing costs and quality of work produced by heating mediums used prior to the installation of the electrically-heated equipment and the savings effected by the adoption of the latter.

Core Baking Ovens

The use of electricity on a large scale in the Norfolk & Western Shops at Roanoke, Va., for heating core-baking ovens was of unusual interest since this form of heat for core baking has not received general acceptance to the same extent that it has in other applications. There are three large electrically-heated core-baking ovens in operation, each oven being 8½ ft. wide, 17½ ft. deep and 11½ ft. high. The electrical capacity of the ovens is 185 kw., 3 phase, 60 cycle, 220 volts. They are truck operated, each oven holding 2 trucks, 6 ft. wide by 8 ft. long, weighing 9,000 lb.

Cores made at these shops are usually quite large. The loss of such cores or the castings in which they are used represents an appreciable sum of money. Hence, an investigation was made to determine if any evidence was available as to actual savings made since the installation of electrically-heated equipment.

An interview with the foreman and assistant foreman, brought out the facts that with the use of coke-fired core-baking ovens, they had to depend on labor to fire the furnaces and attempt some sort of temperature control. The oven was often either too hot or not hot enough, with the result that most cores were underbaked, while a considerable number were overbaked. Occasionally the entire day's work of a core maker would be lost when burned cores would fall to pieces. Castings were repeatedly lost on account of blow holes caused by green or partly baked cores. In many instances, these small holes, caused by the escape of excess vapor, did not show up until the casting was being machined, and sometimes the major part of the machining had been done before the defect could be discovered.

Since using electric heat an improvement has been noted in the castings. The difficulty of blow holes resulting from underbaked cores has been completely eliminated. An average charge of cores per oven will weigh 9,000 lb., and the power consumption is 800 kw.-hr. per bake. At a cost of 8 mills, the power cost is $6.40

* This article appears in two parts, the first of which was published in the February issue.

† The author is special representative of the Westinghouse Electric & Manufacturing Company.

per oven per bake, or $19.20 for the three ovens. The average value of the cores for the three ovens is $150 including labor and material, and for the steel castings annealed and sand blasted $2,000. The saving in loss of cores is placed at three per cent, or $4.50 per day, and the saving in the loss in steel castings at one and one-half per cent, or $30 a day.

Using fuel-fired ovens, the labor of 75 per cent of one man's time was required for firing and watching the ovens. This amounts to 6 hours at 57 cents per hour, or $3.42 per day.

A summary of the total annual savings for the three electric core-baking ovens show the following:

Savings due to spoiled cores	$1,350
Saving in steel castings	9,000
Labor for attending ovens	1,026
Total gross savings	$11,376
Power cost	5,760
Net savings per year	5,636

A summary of the opinion expressed relative to the electric core-baking ovens indicated that the objections raised in connection with the coke-fired ovens had been minimized and in some cases entirely eliminated.

Armature Baking Oven

In the electrical repair department there is installed an oven for baking varnish on electrical coils, such as armatures, field coils, stators, and locomotive headlight generators. These parts, when brought in for repairs, are given a final treatment of an impregnating varnish and then baked in an electric oven from 24 to 72 hours at a temperature of 250 deg. F.

The oven is a standard product designed and sold for such purposes. The inside dimensions are 4 ft. 2 in. wide, 9 ft. 8 in. long, 6 ft. 2 in. high in the clear, exclusive of the space required by the heaters mounted along the sides. An exhauster set is used for forced ventilation and for recirculating the air. The electrical capacity is 30 kw.

The foreman of the electrical department stated that from his records, the useful lives of the coils impregnated and baked in the electric oven had been extended to double the life prior to the adoption of the method. When baking the coils in a fuel-fired oven, it is practically impossible to maintain sufficiently close temperature regulation to prevent underbaking or overbaking coils, which treatment is not better than no baking at all. This is advanced as the reason why electrically-baked coils have doubled the life of those used before the installation of the electrical equipment. Small coils are dipped in the varnish, allowed to drain, and hung up in the oven for baking. Large coils are sprayed with a spray gun and run into the oven on a truck. All coils are thoroughly baked out before being impregnated. The oven has been in operation, day and night, seven days a week, for five years and not one cent has been spent for repairs.

In the winding department there are four armature winders and four laborers employed at a total labor cost of $1,456 per month. Since the life of coils has been increased 100 per cent since using the baking oven, the amount of labor that would be required in the winding department would have amounted to $2,912 a month, or a direct saving of $1,456 a month or $17,472 per year.

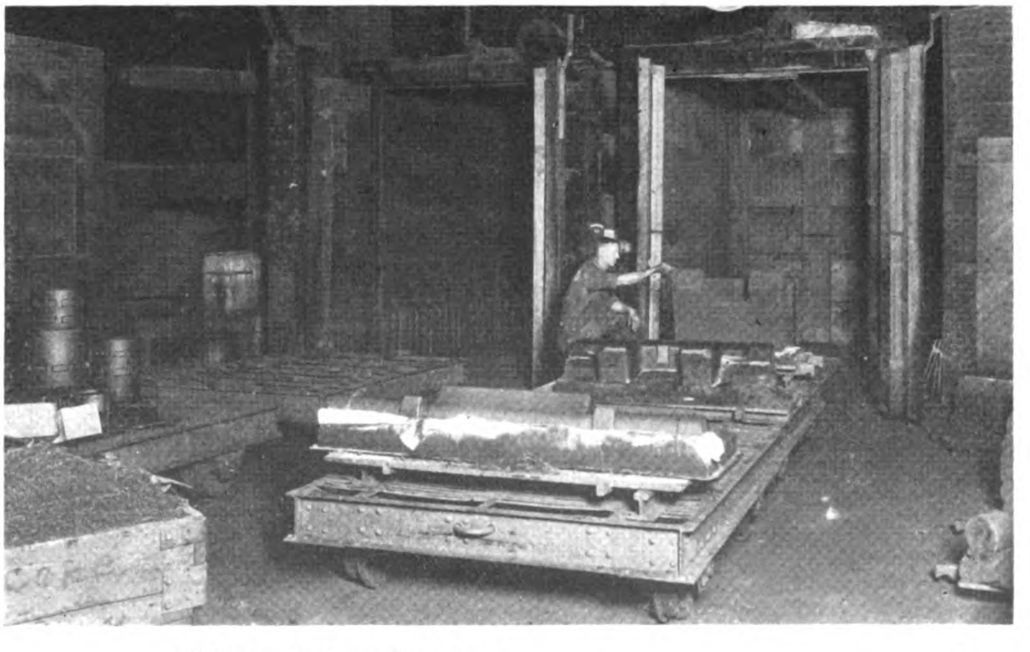
Babbitting Bearings

The babbitting department process consists of melting down the babbitt from the old journal bearings, machining and tinning the brasses, babbitting and milling the bearing. The worn out journal bearings coming into the department are delivered in a truck along side an electrically-heated rectangular melting pot, 20 in. wide, 54 in. long, 18 in. deep, which is heated with five, 10-kw. immersion heaters. The temperature of the bath is regulated automatically at 700 deg. F. The brasses are placed directly in the bath, and when the level of the bath rises near to the top of the vessel, the babbitt is ladled out into molds, producing pigs weighing 80 lb. each.

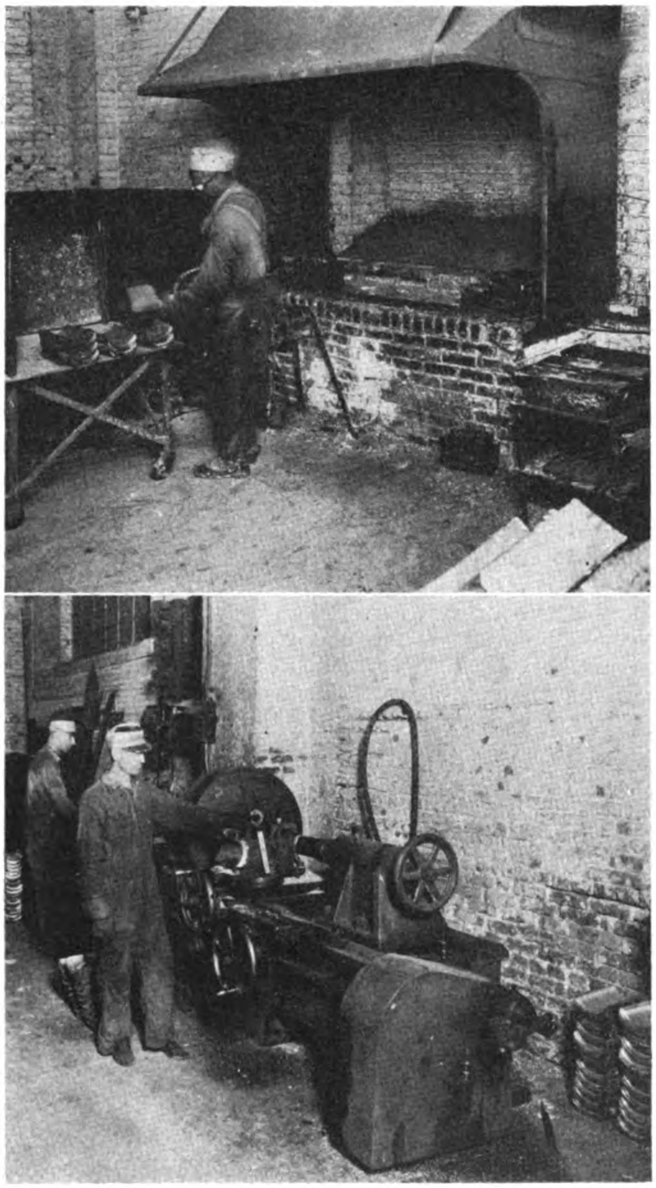
From 400 to 500 worn out bearings are melted down each 8-hour day. After each brass is removed from the bath, it is thoroughly brushed with an air-driven revolving brush, and then inspected for cracks, flaws, or any defects which would make it unsuited for further use. This results in 50 per cent of the brasses being discarded and scrapped. Those passing inspection are placed in a truck, and conveyed to a double milling machine, operated by two men, who mill out the brasses so as to obtain a bright surface for the tinning of the bearing.

The tin pot is also rectangular, 20 in. wide, 30 in. long, and 18 in. deep, and is heated with four 7½-kw. immersion units, having automatic control. The brasses are swabbed with muriatic acid, placed in the tin bath, and kept there in readiness for receiving the babbitt.

The brasses are removed from the tinning pot in pairs,



Core-baking ovens Nos. 1 and 2, each having an electrical capacity of 185 kw. The installation of electrically heated core-baking ovens has resulted in a reduction in loss of cores and a reduction in loss of steel castings valued at many times the cost of the electric current



Top: Electrically heated melting pot where the babbitt is melted out of the old bearings—The brasses are cleaned with a revolving brush, inspected, and those passing the inspection are sent to the boring machine—Bottom: The double lathe used for boring the brasses after inspection

placed on a mandrel, and held in place by means of push rods operated by compressed air cylinders. The babbitt is then ladled into the brasses. The babbitt pot is of the circular type, 21 in. in diameter and 19 in. deep and has 22-kw. capacity, with automatic temperature control. The babbitt used is a lead base, having an approximate composition of 4 per cent tin, 8 per cent antimony and 88 per cent lead. Approximately 1,200 lb. of old babbitt and 1,200 lb. of new babbitt is used every eight hours. The old babbitt is analyzed and a make-up added to keep up the analysis.

After the bearings are poured, they are smoothed off and placed in a finishing milling machine, where they are bored out to exact size.

An analysis of the advantages of electric heat in this department disclosed that the life of a bearing is affected by the temperature to which the babbitt is heated. A variation in temperature of 200 deg. F. from normal will result in a bearing life of only one-fifth of the life that should be obtained under proper temperature conditions. Overheating the babbitt, followed by pouring at the proper temperature is as injurious as pouring at the overheated temperature.

With the coke fuel previously used, a wide variation in temperature resulted. Since using electric heat, the temperature is automatically maintained at a pre-determined point, and it is conservatively estimated that the bearing life has been more than doubled.

There are nine men, including laborers, in the babbitting department who are engaged in melting down old journal bearings and cleaning brasses, machining brasses, tinning bearings and babbitting, trimming and milling bearings. The total labor cost is $4.75 per hour.

With a production of 5,000 bearings a month, at a labor cost of $988, the average labor cost per bearing is 19.25 cents. An average of 1,200 lb. of new babbitt metal per day is used, or 27,200 lb. a month, at 25 cents per pound, making a metal cost of $6,800, or $1.36 per bearing. The total labor and material cost is therefore approximately $1.55 per bearing.

Using fuel-fired furnaces for melting the babbitt, it is estimated that the percentage of worn out bearings for various causes would be distributed as follows: general wear and tear, 50 per cent; improper lubrication, 25 per cent; poor babbitting, 25 per cent.

An analysis of the above would indicate that 25 per cent of the bearings may be defective on account of not being poured at the proper temperature, and that 75 per cent may fail because of wear and tear or improper lubrication before they have a chance to wear out. The savings that may be said to be effected directly by the babbitting will be 12.5 per cent of the total failures, or 625 bearings on a monthly production basis of 5,000 bearings. With the cost of labor and material set at $1.55 per bearing, the monthly savings would be $968.75.

Each of the 625 bearings worn out prematurely must be replaced in the car, at an average labor cost of 77 cents per bearing, or a total cost of $481.25 per month, for labor of replacing bearings.

No record was available as to the former cost of fuel, or the present power consumption. On the basis of similar installations, a conservative estimate can be made of the electric consumption as follows:

The connected load is 102 kw. The average hourly consumption will be 70 per cent of this, or 71 kw. per hour for 208 hours per month, or 15,000 kw.-hr. During the heating-up period each morning, the power is on continuously for 90 minutes, which will add 4,000 kw.-hr. per month, making a total of 19,000 kw.-hr. consumed. At a rate of 8 mills, the cost will be $152 per month.

From the foregoing, it will be noted that the net monthly saving is $1,450, the total of the babbitting-operation savings of $968.75 and the savings effected by eliminating premature installations of bearings, which is $481.25. Since the monthly cost of electric power is $152 the production of better babbitt and longer life of bearing is therefore worth 9.6 times the cost of the electric power.

Another interesting phase of this situation is that the A.R.A. interchange cost of rebabbitting and replacing 6-in. by 11-in. journal bearings is $2.50, which is the difference between $7.50, the cost of a new brass, and $4.90, the allowance on the old one.

With an extended life of 100 per cent on 25 per cent of the bearings, the possible savings on the basis of a billing of $2.50 per bearing replaced by foreign railroads above will represent a considerable sum each year.

The arc-type steel-melting furnace, used in the foundry at the Roanoke Shops was originally rated at 3½ tons capacity, but is now being operated at a capacity of 4½ tons per heat. It was installed to facilitate the securing of castings for repair parts.

Three heats are secured each night. The molders finish their work at 4 p.m. and by 5 or 5:30 p.m. the first heat is ready for pouring. The first heat requires approximately 3½ hours from the time the current is first turned on until it is ready for pouring. Successive heats require from 2½ to 3 hours.

The current consumption averages approximately 740 kw.-hr. per ton, a commendable performance considering that the furnace is in operation only from 12 to 13 hours per day. The furnace is operated entirely on scrap materials, made up largely of couplers, angle bars, borings and turnings.

General Summary

In the analysis given in the foregoing, nothing has been said about the former cost of fuel, or the relative maintenance costs of fuel and electric furnaces. The cost of fuel used at the Roanoke Shops was considerably below the average, since the hauling was done by the Norfolk & Western. Oil was delivered at Norfolk via ships at approximately three cents a gallon. The power consumption has been figured conservatively, so that the actual consumption will be within 10 per cent of the figures shown, plus or minus. However, neither the cost of fuel nor the cost of power are deciding factors, and should not be treated with too much importance. Equal attention should be given to other important items entering into the costs analysis.

The maintenance cost on the electric furnaces and oven since installation has been practically nothing, with the result that further savings may reasonably be expected in addition to those outlined in detail. The cost of electric power, whether it be for motors, electric lights, electric ovens or furnaces, becomes a secondary matter when due consideration is given to the results.

One may well inquire as to the reason why electric heating produces such results in comparison with fuel-fired equipment.

Suppose it is desired to anneal castings at 1,650 deg. F. For best results the temperature of the castings should not vary from normal more than 25 deg. If fuel is used, it is necessary to start with heat generated probably at as many as eight points with a flame temperature of about 3,000 deg. F. A thermocouple is placed within the furnace, care being taken to see that it is not set in the path of the flame. The temperature at that point is called the temperature of the furnace. While this may be the temperature of part of the charge, some parts of the charge will be subjected to the direct radiation of the flame or to an incandescent wall on which the flame is impinging, while other parts will be entirely out of reach of such radiation, and even out of reach of any convection currents. It is not at all difficult to imagine the conditions of heating which will result.

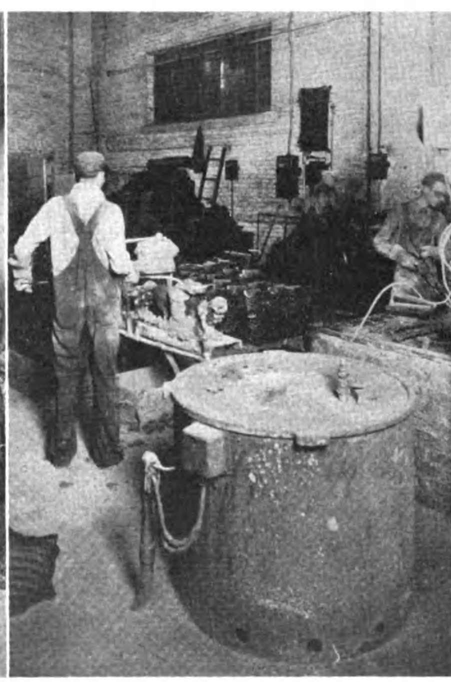
Summary of Power Costs and Savings Effected by the Use of Electric Heat at Roanoke Shops of the N. & W.

Application	Power cost per year	Total savings per year
Babbitting of bearings	$1,824	$17,400
Armature and Coil baking	864	17,472
Tool heat treating	600	6,854
Carburizing	1,413	18,720
Core baking	5,760	11,376
Annealing steel castings	7,344	30,222
Grand Totals	$17,805	$102,044

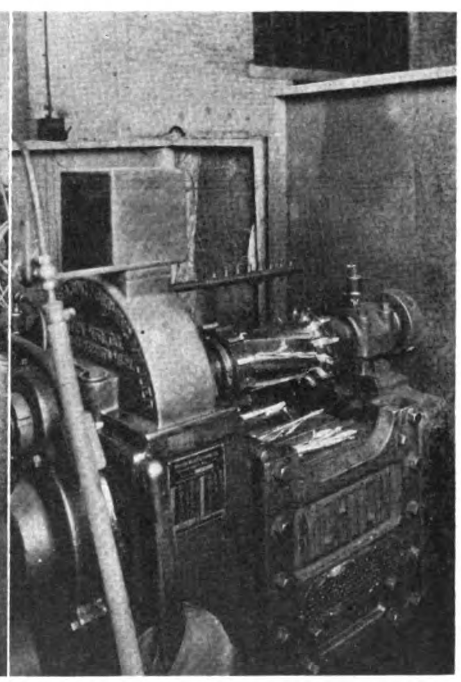
In comparison with this, where a temperature of 1,650 deg. F. is required for the heat-treatment of castings, suppose the heat were generated, not from eight points, but from an infinite number of points, and that the maximum temperature is limited to 1,700 deg. F. instead of 3,000 deg. F. Suppose the heating elements are placed within this furnace chamber in such a manner as to compensate for all door losses and other naturally cold areas within the furnace chamber, and in addition, liberate heat uniformly to the charge. The result is that the furnace atmosphere at every point is at the same temperature, and the entire charge will gradually come up to the temperature of the controlling thermocouple, or 1,650 deg. F., no more, no less.

If time had permitted, many other items of direct saving could have been investigated and brought to light. Deducting the entire cost of electric heating at the Roanoke shops from the savings as recorded, a net minimum saving of $84,139 a year is shown.

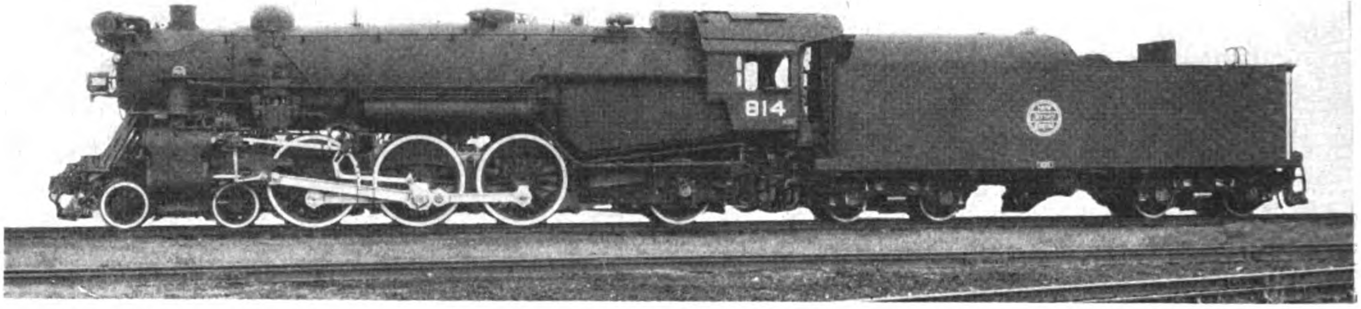
The rectangular tin bath, electrically heated, into which the brasses are placed—The brasses are kept in the bath until ready for receiving the babbitt



Two brasses are placed on a mandrel and held in place by air-operated push rods—The electrically heated babbitt pot is shown in the foreground.



After the bearing has been poured and the edges trimmed, it is placed in a milling machine where it is bored to a specified size.



Central of New Jersey 4-6-2 type locomotive built by the Baldwin Locomotive Works

New Jersey Central 4-6-2 Type Locomotive

Purchased to meet special operating conditions requiring the replacing of locomotives of similar type having a tractive force of 46,841 lb. The new power operates at a boiler pressure of 240 lb. and develops a tractive force of 52,180 lb.

FIVE 4-6-2 type locomotives were delivered in October, 1930, to the Central Railroad of New Jersey by the Baldwin Locomotive Works. These locomotives have considerably greater tractive force than any Pacific type locomotives heretofore used on this road. They bear the road numbers 810 to 814 inclusive and are a modification of previous 4-6-2 designs, developed to meet special operating needs.

With the object of obtaining a locomotive especially suited for handling heavy suburban trains at reasonable speeds and also certain through trains such as the "Williamsporter" and the Philadelphia and Scranton express trains, on the Lehigh and Susquehanna division, where heavy grades are encountered and close clearance restrictions are imposed; a driving wheel 74 in. in diameter was adopted. All previous 4-6-2 type locomotives on this road have had 79-in. drivers. The new locomotives have 26-in. by 28-in. cylinders, the same as their predecessors but the boiler pressure has been increased to 240 lb. per sq. in. instead of 230 lb. which is used on the preceding order of 4-6-2 type locomotives, bearing road numbers 831 to 835, which haul the "Blue Comet" trains between Jersey City, N. J., and Atlantic City and the "Bullet" fast express between Jersey City and Wilkes-Barre, Pa. With these changes, the maximum tractive force has been raised to 52,180 lb. compared with 46,841 lb. for the previous locomotives built in 1927. The weight on the drivers has been increased from 197,660 lb. to 205,900 lb. and the total weight of the engine from 326,470 lb. to 333,830 lb.

In order that these locomotives might be used on the New York and Williamsport express trains operating through the Lansford tunnel on the Nesquehoning branch, between Mauch Chunk, Pa., and Tamaqua, it was necessary to restrict the locomotives to the tunnel clearance limits imposed at this point. The overall height from the top of the rail to the top of the stack was therefore reduced from 15 ft. ⅝ in. on the previous engines to 14 ft. 9-⅞ in., while the center line of the boiler is 2½ in. lower, measuring 9 ft. 10½ in. from the top of the rail.

The capacity of the tenders for the new 4-6-2 type locomotives has also been increased to 13,100 gal. of water, compared with 10,000 gal. for their predecessors but the coal capacity of 15 tons remains the same. This change necessitated increasing the length of the tender-wheel base from 23 ft. 10½ in. to 29 ft. 4½ in. As on the previous order, the water-bottom type of tender

Table Showing the Principal Dimensions, Weights and Proportions of the New Jersey Central 4-6-2 Type Locomotives

Railroad	Central Railroad of New Jersey	
Builder	Baldwin Locomotive Works	
Class	G-4S	G-3S
Road numbers	810 to 814	831 to 835
Type	4-6-2	4-6-2
Service	Passenger	
Cylinders, diameter and stroke	26 in. by 28 in.	26 in. by 28 in.
Valve gear, type	Walschaert	
Valves, piston type, diameter	13 in.	13 in.
Maximum travel	6½ in.	6½ in.
Steam lap	1⅛ in.	1¼ in.
Lead	¼ in.	¼ in.
Exhaust clearance	¼ in.	¼ in.
Weights, in working order:		
On drivers	205,900 lb.	197,660 lb.
On front truck	63,830 lb.	65,850 lb.
On trailing truck	64,100 lb.	62,960 lb.
Total engine	333,830 lb.	326,470 lb.

Total tender	253,900 lb.	217,000 lb.
Total engine and tender	587,730 lb.	543,470 lb.
Wheel bases:		
Driving	13 ft. 10 in.	13 ft. 10 in.
Total engine	36 ft. 9 in.	36 ft. 8 in.
Total engine and tender	78 ft. 1/8 in.	72 ft. 2 in.
Wheels, diameter outside tires:		
Driving	74 in.	79 in.
Front truck	36 in.	36 in.
Trailing truck	55 in.	55 in.
Journals, diameter and length:		
Driving, main	12 in. by 14 in.	12 in. by 14 in.
Driving, others	11 in. by 14 in.	11 in. by 14 in.
Front truck	7 in. by 12 in.	7 in. by 12 in.
Trailing	9 in. by 16 in.	9 in. by 16 in.
Boiler:		
Type	Conical	Conical
Steam pressure	240 lb.	230 lb.
Fuel	Bituminous coal	
Diameter, first ring, outside	78 in.	78 in.
Firebox, length and width	126 1/8 in. by 96 1/4 in.	126 1/8 in. by 96 1/4 in.
Tubes, number and diameter	207—2 in.	251—2 in.
Flues, number and diameter	45—5 3/8 in.	36—5 3/8 in.
Length over tube sheets	18 ft. 8 in.	19 ft.
Grate area	84.3 sq. ft.	84.3 sq. ft.
Heating Surfaces:		
Firebox	228 sq. ft.	228 sq. ft.
Combustion chamber	64 sq. ft.	64 sq. ft.
Arch tubes and syphons	109 sq. ft.	113 sq. ft.
Flues and tubes	3,190 sq. ft.	3,444 sq. ft.
Total evaporative	3,591 sq. ft.	3,849 sq. ft.
Superheating	1,000 sq. ft.	791 sq. ft.
Combined evap. and superheat.	4,591 sq. ft.	4,640 sq. ft.
Tender:		
Style	Water bottom	
Water capacity	13,100 gal.	10,000 gal.
Fuel capacity	15 tons	15 tons
Wheels, diameter	36 in.	36 in.
Journals, diameter and length	6 1/2 by 12 in.	6 1/2 by 12 in.
Maximum tractive force	52,180 lb.	46,841 lb.
Weight proportions:		
Weight on drivers ÷ total weight engine in per cent	61.67	60.54
Weight on drivers ÷ tractive force	3.94	4.21
Total weight engine ÷ combined heating surface	72.71	70.36
Boiler proportions:		
Tractive force ÷ comb. heat. surface	11.37	10.10
Tractive force × dia. drivers ÷ comb. heat. surface	841	798
Superheat. surface in per cent evap. heat. surface	27.84	20.55
Comb. heat. surface ÷ grate area	54.46	55.04
Total firebox heating surface ÷ grate area	4.76	4.80
Total firebox heating surface in per cent evap. surface	11.16	10.52

frame is used with the side sheets welded to the frame, making a smooth finished surface and an attractive appearing tender. The tenders are equipped with water scoops as on previous 4-6-2 type locomotives.

Some modifications have also been made in the design of the boilers of the new locomotives. The diameter at first course of 78 in. outside has been retained, also the same sheet thickness of 13/16 in. On account of the 10-lb. increase in boiler pressure, the tapered second course thickness was made 29/32 in. instead of 7/8 in., while the third course was changed from 7/8 in. to 15/16 in. A larger superheater is employed having 45 instead of 36 units, while the number of 2-in. tubes has been reduced from 251 to 207. The superheating surface is 1,000 sq. ft. instead of 791 sq. ft. The length over the tube sheets has been reduced from 19 ft. to 18 ft. 8 in. The grate area remains as before at 84.3 sq. ft.

The driving-wheel base of the new 4-6-2 type is the same as on previous Pacifics, viz.; 13 ft. 10 in. The diameter of the driving wheels can be increased in the future, if desired from 74 in. to 79 in., without great difficulty or expense. The total wheel base is 36 ft. 9 in., which is 1 in. longer than previous engines, due to the use of an engine truck having a 7-ft. wheel base instead of 6 ft. 10 in. Alemite grease lubrication fittings are used on the driving boxes for shoe and wedge fits and hub bearings, and also on the spring rigging.

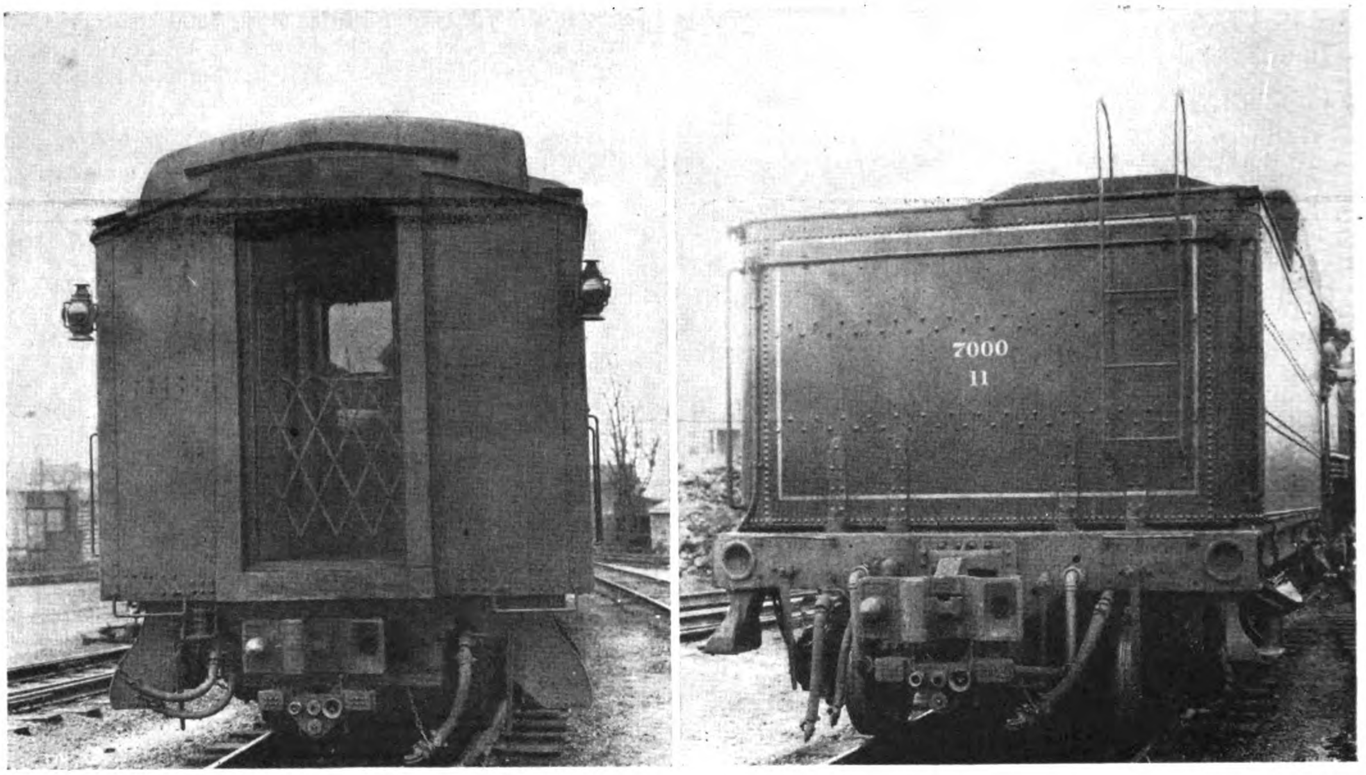
Among the features of special interest is the placing of all piping as far as possible under the jacket, which improves the appearance of these locomotives. Extra heavy copper piping was used for the various pipe lines, such as air lines to the sanders, bell ringer, etc. The pipes to the feedwater heater have also been concealed in the smoke box, as will be noted from the illustration of the locomotive. A special arrangement of piping with cast steel elbows is used where the feedwater piping enters and leaves the smokebox.

Other features of interest include a Westinghouse

(Concluded on page 128)

List of Special Parts, Appliances and Equipment Applied on the New Jersey Central 4-6-2 Type Locomotives

Road	Central Railroad of New Jersey
Builder	Baldwin Locomotive Works
Number built	Five
Firebox and Boiler:	
Blower fittings, smokebox	Barco
Blower valve	Strong Statite
Blow-off cock	Okadee, 2 in.
Boiler check valves	Consolidated
Boiler tubes	Toncan iron, 2 in.
Boiler plate	Lukens, o.h. steel
Feedwater heater	Elesco
Firebox sheets	Worth Steel; Bethlehem Steel
Fire brick arch	General Refractories Co.
Fire door	Franklin, Butterfly
Injector	Sellers, non-lifting No. 12 6/10
Lagging	Johns-Manville
Pipe covering	Unarco Insutape
Rivets	Victor, steel
Safety valves	Star Brass Co.
Staybolts, flexible	Alco
Staybolt iron	Ulster special
Stoker	Standard, modified type B
Syphons, Thermic	Locomotive Firebox Co.
Superheater	Type A
Washout plugs	Huron, corner of firebox and barrel
Water gages	Hanlon, 2-bullseye
Water-gage cocks	Sargent, 2-seat
Whistle	Star Brass Co., 6-tone chime
Cylinders and Running Gear:	
Axles, driving	O.h. carbon steel, medium annealed, A.R.A. spec. hollow-bored, 3 in.
Axles, engine truck and trailer	Hammered, o.h. carbon steel, annealed, A.R.A. spec.
Buffer, radial	Franklin Economy
Crank pins	O.h. carbon steel, annealed
Crossheads, cast steel	American Steel Foundries Hylastic
Crown brasses, driving box	National Bearing Metal Co.
Cylinder and valve bushings	Eddystone, cast iron
Cylinder cocks	Okadee type E
Drifting valve	Ardco
Eccentric cranks	Forged steel
Engine truck	General Steel Castings
Frame bolts	Ulster, refined iron
Frames, main	General Steel Castings, vanadium steel
Front bumper	General Steel Castings
Packing, piston-rod and valve-stem	King Metallic
Packing, rings, piston and valve	Hunt-Spiller gun iron
Power reverse gear	Alco
Rods, main and side	O.h. carbon steel, medium annealed
Rods, piston	O.h. carbon steel, medium annealed, hollow bored.
Sanders	King, double type
Springs	Crucible Steel Co., chrome silico-manganese steel
Tires, driving and truck	Midvale, o.h. steel
Trailing truck	General Steel Castings, Delta type
Cab:	
Bell ringer	Transportation Devices Corp
Clear-vision window	Central Railroad of New Jersey
Gage, steam	Ashcroft, 6 3/4 in.
Lighting equipment and generator	Pyle-National
Throttle	Bradford, Chambers back-head type
Miscellaneous:	
Air brakes	Westinghouse, E. I.
Coupler, pilot	National Malleable Castings
Flexible engine tender connections	Barco
Lubrication, grease, for springs, spring rigging, shoes and wedges and driving box hubs	Alemite
Lubricator, mechanical	Detroit, 16-feed, 32 pints
Pipe unions	Corley
Pipe, flexible joints, air, steam	Barco
Steam-heat reducing valve	Leslie
Steam-heat coupler, rear of tender	Gold, 804 S
Tender:	
Axles	Hammered carbon steel
Clasp brakes	American Steel Foundries
Springs, elliptic	Crucible Steel Co., chrome-silico manganese
Tank plates	Copper-bearing steel
Tender coupler	National Malleable Castings, 6 in. by 8 in.
Tender draft gear	Miner friction, A-5-XB
Tender frame	General Steel Castings, water bottom type, cast steel
Tender trucks	General Steel Castings, four-wheel type, cast steel



Passenger car and tender with the O-B Tight-Lock Coupler and train-line connections

Baltimore & Ohio Tests Coupler Equipment

A report of the progress made in the development of an automatic "tight-lock" car coupler for passenger-train service in which steam, air and electric train-line connections have been incorporated

THE Baltimore & Ohio has been testing the O-B Tight-Lock coupler in passenger train service since December, 1928. This coupler, a description of which appeared in the Railway Age, Daily Edition, June 20, 1928, page 1420, is manufactured by the Ohio Brass Company, Mansfield, Ohio. These tests are being conducted to develop an automatic tight-lock coupler which will inter-couple with all existing couplers and provide automatic connections for the steam, air brake, air signal and electric systems. It is the desire of those in charge of this development work to combine all these connections between cars in one structure, so that when the car couplers are unlocked, the valves in the steam and air signal line will close automatically and at the same time open the electric circuits. This article is a report of the progress which has already been made. Further tests of this equipment are contemplated.

Results thus far obtained with a train of three passenger cars and a tender equipped with the O-B Tight-Lock coupler and the automatic braking and service connections indicates, aside from certain minor changes, that the design of the coupler is based on sound principles.

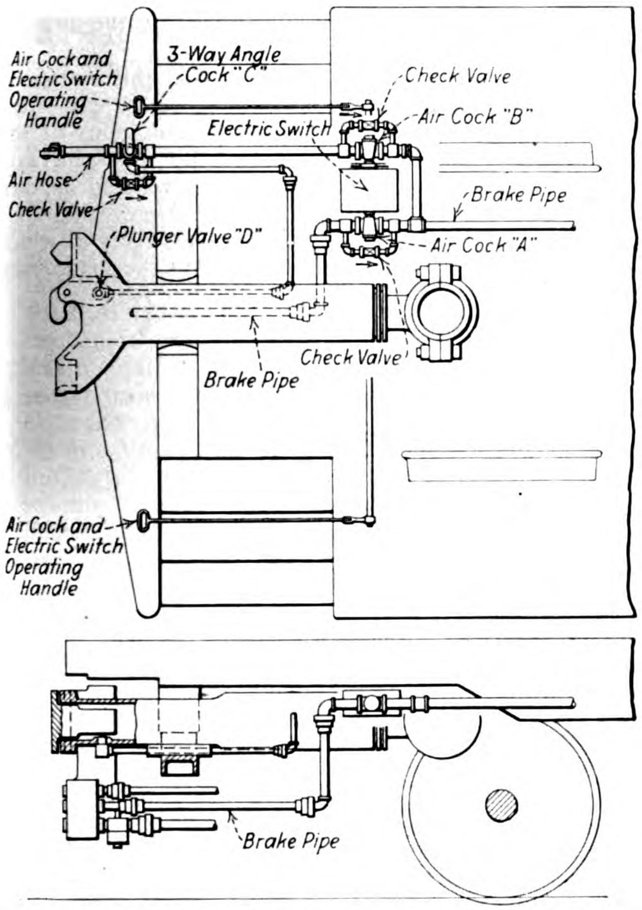
The Design of the Coupler

The O-B Tight-Lock coupler is designed to secure a rigid connection between coupler heads when coupled. The method employed is an adaption of the principle of the Miller hook couplers which the Ohio Brass Company has supplied extensively to electric railways. Lateral wings of the pin-and-funnel type on the coupler head are so designed that, as the coupler knuckles engage the opposing guard-arm faces, the wings are brought into register. When the opposing faces of these wings are in close contact, the pin-and-funnel connections hold the heads immovably alined with respect to each other, and the knuckles are locked by a spring-actuated wedge lock which moves forward in the coupler shank. The lock spring is proportioned so that its action is faster than the recoil of the mass of the car even under collision shocks. The "making" of the coupling is thus assured under any conditions which bring adjoining coupler heads together, and the knuckles may therefore be left in the open position when not coupled.

Inasmuch as a rigid drawbar connection between

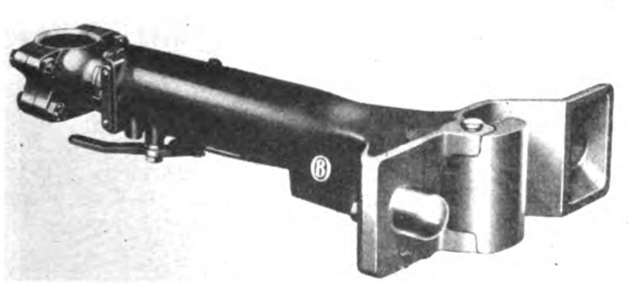
adjoining cars is obtained, suitable provision must, therefore, be made for universal angular movement between the drawbar and the car body, as well as for some tortional movement between adjoining cars. This is provided for in a ball-and-socket anchorage to the underframe, a method of attachment thoroughly established in electric railway practice.

The shank of the O-B coupler contains its own draft



Arrangement of brake-pipe connections where the automatic connector head is carried by the coupler

gear which eliminates the necessity of separate draft-gear connections for the coupler. This coupler also locks the cars together so that in the event of a derailment

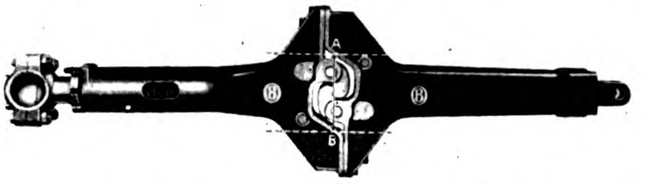


The O-B Tight-Lock coupler

it would be practically impossible to separate them unless the couplers themselves should be broken. This feature helps to prevent one car from telescoping another in the event of a collision, because the coupler when coupled acts as a beam under the end sill platform of adjacent cars. There is also an additional safety feature, if the truck should for any reason leave the track or the coupler travel laterally beyond its predetermined distance. This movement opens a check valve to the atmosphere and causes an emergency application of the brakes to the entire train.

With the rigid alinement of the heads of the tight-lock couplers on impact, the coupler heads themselves become suitable supports for connector heads to carry both hose and electrical connections. For passenger service, the connector blocks are designed to carry signal, brake-pipe and steam-heat ports, and a wide scope is provided for the arrangement of electric-circuit contacts.

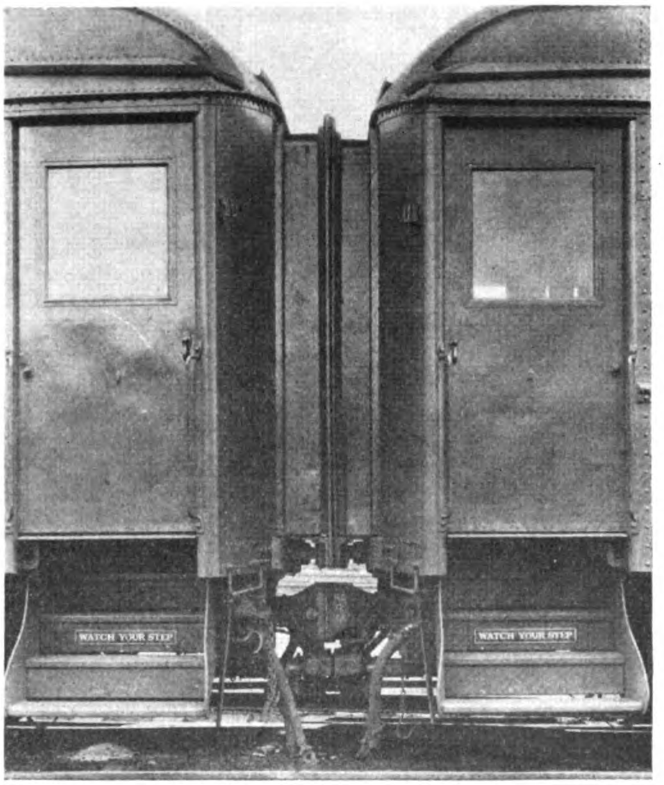
An accompanying drawing shows the arrangement of brake-pipe connections where the automatic connector head is carried by the coupler, which has been worked



The standard A. R. A. contour is indicated by the portion of the coupler between the lines A and B

The coupler on the left has the enclosed friction-ring type draft spring and ball anchorage. The coupler on the right is designed for use with various types of friction draft gears now in service.

out to make unnecessary the use of an adapter for interchange with cars fitted with the usual hose connections. The end of the brake-pipe is divided into two branches, one of which leads to the connector head in the train. Each car is equipped with an air-cooled transformer of 1.5-kw. capacity which reduces the lighting voltage to the standard 32 volts. The electric



Passenger cars coupled with the O-B Tight-Lock coupler and automatic brake-pipe connections

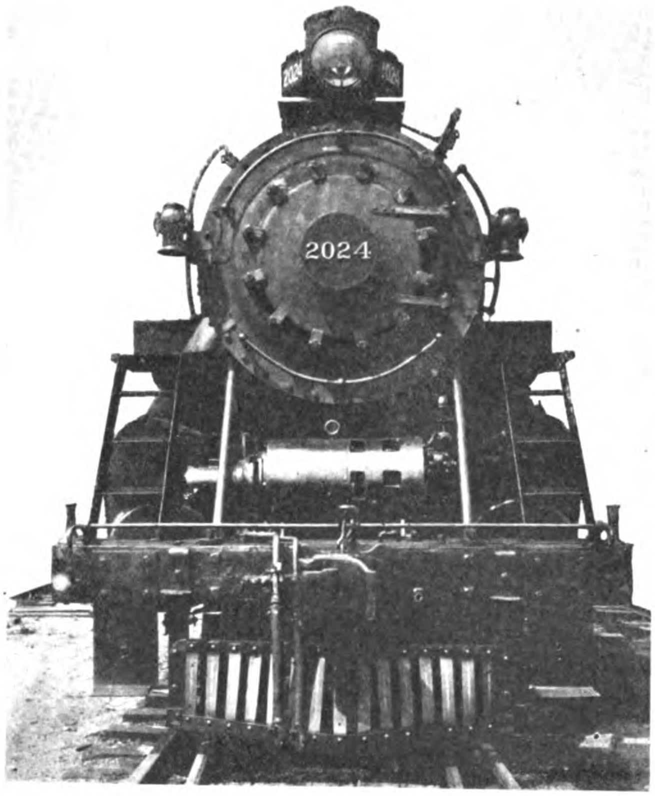
connections between the tender and the several cars in the train are also made automatically.

The O-B Tight-Lock coupler eliminates the necessity for employees going between or under cars to perform

coupling and uncoupling operations. In addition to the value derived from the prevention of telescoping of cars as explained in a previous paragraph, the rigidity of the connection provided by the O-B Tight-Lock coupler prevents vertical play between cars, allowed by the ordinary coupling arrangement. It has been found that this effectively overcomes excessive oscillating movements so that cars ride more steadily which in turn contributes to greater ease and more comfort for passengers when trains are negotiating curves. There is also an appreciable reduction in weight as compared with the equipment in general use.

Central Current Generation

The utilization of the O-B Tight-Lock coupler in connection with couplings for the braking and service lines, as well as electric circuits permitted and simplified the application of what is considered to be the first alternating current system ever applied on railway rolling equipment. The railroad desires to supplement, and under certain conditions supplant, present lighting systems and provide a continuous source of electrical energy in sufficient quantity to provide for the operation of air-conditioning equipment, elecrtic refrigeration, vacuum cleaners, hot water heaters, cigar lighters, window operating devices, coffee percolators, etc.



Front-end view of the Baltimore & Ohio locomotive showing the central generating unit

The system being tested consists of a 25-kw., 220-volt alternating current steam turbo-generator of the self-regulating and self-exciting type mounted on the front end of the locomotive under the smoke box. Steam for the operation of the turbine is supplied from the locomotive and no additional duties are imposed upon the engineman except that of opening or closing the steam-supply valve. A voltmeter has been installed in the locomotive cab.

Alternating current at 60 cycles and at 220 volts is conveyed from the turbo-generator to the several cars and the other to the standard air hose. The latter is fitted with a three-way angle cock at the sill and, in addition, there is an air cock in each line. The two latter valves are interconnected and operated by the same handle so that when one is open the other is closed. The drawing also shows an application for electrical connections in which the cut-out switch for the electrical leads to the connector is also operated by the air-cock handle.

It is believed by the management that this system of practically continuous lighting- and power-supply offers promise of overcoming the capacity limitations of the existing intermittent supply from the axle-generator system using either belt or positive drive, and appears to offer promise of making available necessities, conveniences and comforts in railway travel, many of which have heretofore been unattainable due to the inadequacy of power supply.

New Jersey Central 4-6-2 Type Locomotive

(Continued from page 125)

pedestal-type brake valve, the pedestal being mounted on a substantial bracket secured to the bottom of the back boiler head; a modified type B Standard stoker, hollow-bored piston rods, a special bracket of rigid design to support the distributing valve and eliminate pipe failures due to vibration, and a special design of heavy four-wheel cast-steel tender truck. This truck provides easy riding qualities for the tender. A tube is inserted in the tender and welded in position to hold the fire tools when not in use. All internal bracing of the tender-tank is welded instead of using the conventional type of rivets to secure the brace plates.

Of particular interest is the use of solid floating bushings of bronze in the main-rod back end and side-rod main-pin connections, instead of the three-piece floating bushing used on the previous engines.

The perforated type of cast-iron grate bar has been applied on these engines, which is supported on cast-steel side and center-support frames. The exhaust ports were enlarged and the steam lap reduced ⅛ in. as compared with the previous 4-6-2 type, which changes have already shown marked savings in fuel consumption and have resulted in a much smarter engine in starting trains. The changes in ports and steam lap together with the use of a 45-unit superheater, has shown a saving of 6 per cent in fuel consumption.

Aside from the changes noted, the general design of the new locomotives follows closely along the lines of their predecessors. The New Jersey Central emblem attractivey striped in gold leaf appears on each side of the tenders. The locomotive and tender are painted in Nile Green.

The design of these locomotives was prepared under the supervision of the mechanical department of the railroad.

Fifty Years Ago.—The Denver & Rio Grande [now the Denver & Rio Grande Western] has contracted for the construction of 144 locomotives with a single builder, the cost to aggregate about $1,000,000. This is probably the largest contract for locomotives ever made and is an evidence of the rapid growth of this remarkable narrow gage enterprise.—Railway Age, January 20, 1881.

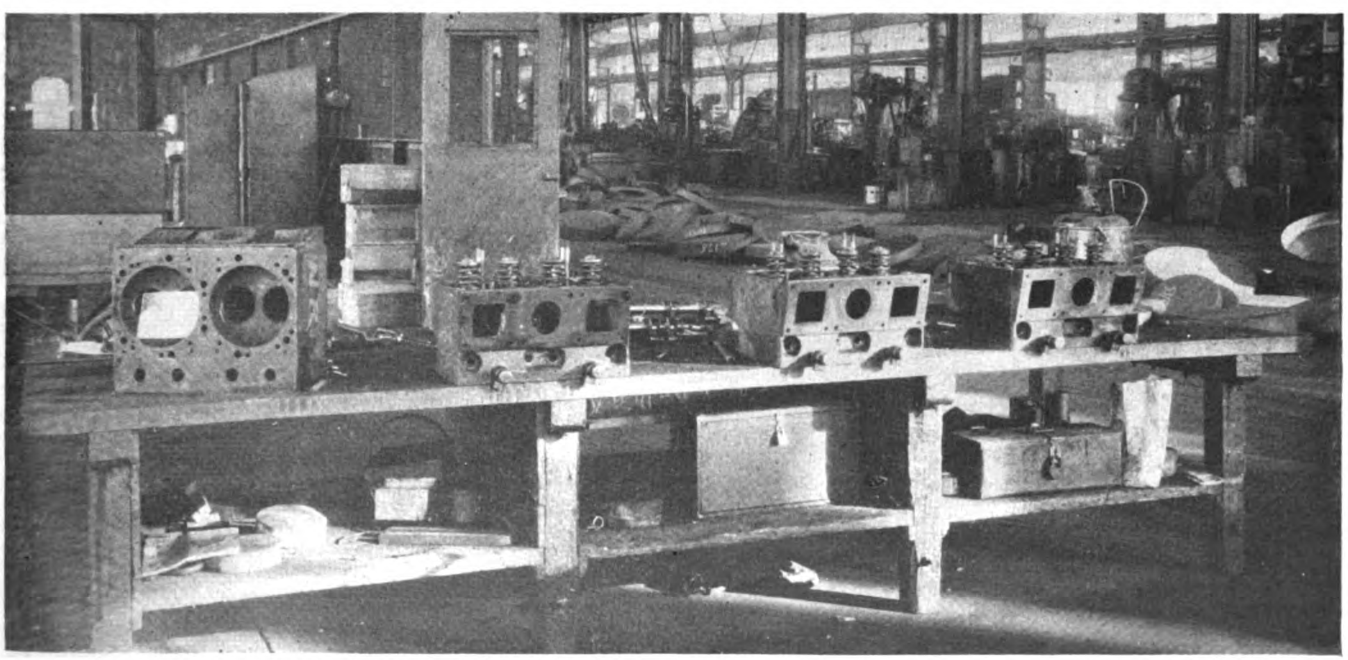
Maintaining Burlington Motor Rail Cars

Heavy repairs on 57 gas-electric cars are centralized at the two main shops of the road where special devices are provided to save time and insure accuracy of operations on the power plants. Responsibility for the condition and performance of the equipment in service rests with a superintendent of automotive service and his supervisors

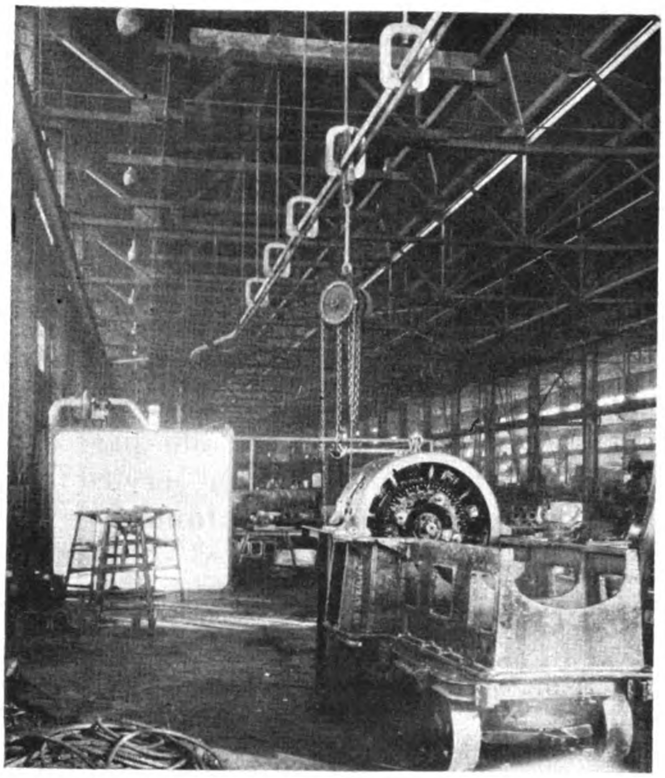
THE Chicago, Burlington & Quincy was one of the first roads to appreciate the possibilities of economy and reduced operating expense due to the replacement of steam service by motorized equipment, which saved fuel and water costs, crew expense, locomotive-maintenance cost, engine handling at terminals, fuel standby loss, cinder-handling expense, and, at the same time, permitted giving better service to the territories served by the Burlington. In addition to seven gas-mechanical cars, the Burlington now operates a total of 60 gas-electric cars in passenger-train service, including two on the Colorado & Southern and one on the Wichita Valley. The 57 gas-electrics on the Burlington proper made 3,341,004 miles in 1930, demonstrating a high degree of availability and economy. Making allowance for out-of-service time due to traffic and causes other than disability, the availability of these cars was 94.0 per cent. Almost 60 per cent of the motor-train mileage was made with trailer equipment, either one or two cars. The cost of gasoline, fuel and lubricating oils per mile was 6.11 cents; repairs, labor and material, 5.03 cents; and total operating expense, 27.04 cents. Allowing 6 per cent interest on the investment and a generous depreciation rate of 8 per cent, these gas-electrics, as shown in one of the tables, earned 28.5 per cent on the investment in 1930 and saved $699,290, or 36.3 per cent of the cost of equivalent steam-train service.

Burlington gas-electric cars are all used in passenger train service, handling passengers, baggage, express, milk and mail, on both branch and main lines. This type of equipment is used to a greater or less extent on practically the entire lines east except between Chicago, Ill., and Aurora; La Crosse, Wis., and St. Paul, Minn.; Kansas City, Mo., and St. Louis. With the exception of two runs by cars on the Colorado & Southern Wray, Colo., and Ravenna, Neb., mark the limit of the present extension of gas-electric operation on the Burlington towards the west. Twenty-one cars are used in main line service. Forty-four cars are equipped for handling railway mail; nearly half of the cars carry express and baggage, but no passengers; none of the power cars carry passengers only.

A study of the power capacities of gas-electric cars on the Burlington shows that there are 14 cars equipped with Electro-Motive, eight-cylinder, 400-h.p. power plants; 43 Electro-Motive, six-cylinder, 275 h.p. power plants; one Brill-Westinghouse, six-cylinder, 250-h.p. power plant; one Electro-Motive, six-cylinder, 225-h.p.



Bench where cylinder heads and other parts are repaired



Gas-electric repair department at West Burlington shops

power plant, and one Mack, 240-h.p., dual-power plant. Nine of the cars are provided with Westinghouse electrical equipment and 51 with General Electric. Seven cars have double-end control, for operation in either direction without turning.

How Light Repairs Are Handled—Few Failures

Light repairs given to the rail motor cars at all terminal and layover points include changing cylinder heads, grinding valves, applying new ignition cables, adjusting bearings, cleaning electrical equipment, installing new rings in air compressor, testing air equipment, changing brake shoes, beams, etc., and renewing any parts necessary. Special attention is given to the condition of trucks and wheels and flange-oiling equipment. Wheel wear is dependent upon a number of circumstances, including the severity of the service and track conditions. In general, wheels make about 35,000 to 45,000 miles before wheeling-truing brake shoes are used to cut down the high flanges, afterwards being trued about every 6,000 miles until the next general shopping. In case of accident or necessary wheel removal for turning, a reserve power truck held at the general shop is applied, thus permitting the car to continue in service. The cars are refinished by painting on the average of about every two years. The front ends of the cars are painted red and yellow to attract attention at road crossings and so that they can be seen at a greater distance by trackmen.

A stock of parts is carried at all maintenance points from the general store at Aurora, which makes all battery repairs and reclaims all crank-case oil, after 1,500 miles of service, by the distillation process, at a cost of 11.2 cents a gal. as compared with 42 cents new. As necessary precautions due to the use of gasoline fuel, the cars are assigned to enginehouse stalls where fires and open flame lights can be kept away. No welding is permitted about these cars and all maintenance forces are instructed in the safe handling of the equipment. No operation of the engine in closed buildings is permitted.

As is to be expected from the high percentage of availability, failures of gas-electric cars are few and far between. There were only 21 failures with 57 cars, making a mileage of 3,341,004, in 1930, or approximately 160,000 miles per failure. Another way of expressing it would be .031 failures per car per month.

The following is a typical failure report for the month of November, 1930:

Car No. 9727, Creston Division, Lost 1 Hr. 53 Min., November 1

Failure was attributed to connecting rod breaking in the crank end of rod, due to an existing fracture.

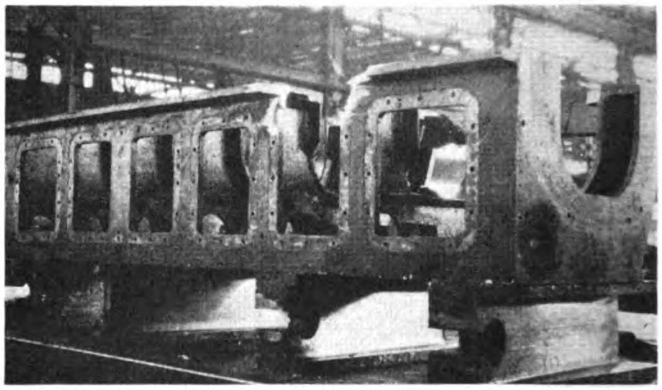
A sample of oil was taken from the crank case after failure occurred. Analysis showed oil to have a very dark appearance, which is evidence of considerable use between oil changes. It has been noted that the bearing of No. 3 rod which failed had been taken up the previous night and possibly pulled up too tight. This, together with the poor condition of the lubricating oil, probably resulted in the bearing becoming hot and gripping the crank pin, due to lack of proper lubrication, causing the rod to fail at point of fracture.

This failure can be attributed to a combination of conditions, which could have been avoided if the following precautions were taken:

Extreme importance of careful inspection of reciprocating parts.

Changing out lubricating oil regularly in order to avoid excessive use and dilution.

Connecting rod crank pin bearings should not be pulled up too tight, but a clearance of .003 in. to .005 in. allowed on the diameter and a lateral clearance of .020 in. equally divided.



Upper half of a broken aluminum crankcase casting which was repaired by welding

Motorman reports that he noticed an unusual sound in engine immediately after leaving the terminal, but he continued operation in this condition for some time before failure of rod occurred. Had he stopped when the unusual sound was first detected and made careful inspection, he probably would have located the trouble, after which a relief engine should have been called and an expensive failure avoided.

Car No. 9811, Lincoln Division, Lost 3 Hr. 55 Min., November 8

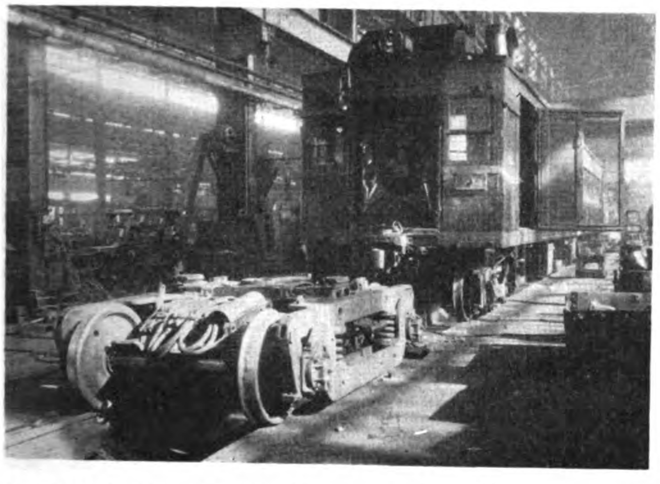
Failure due to piston breaking in No. 3 cylinder. It is impossible to make inspection of pistons unless cylinder head is removed and piston pulled. Fractures in piston are most times produced by detonations caused by pre-ignition and by excessive heating of engine due to overload. Incorrect proportions of fuel components will also contribute to detonation by causing violent explosions when ignited, instead of merely burning under high pressure as when properly proportioned. Detonation from this cause can be somewhat diminished by supplying water to the carburetors which injects a spray of moisture into a fuel mixture. This application has been made to a few of our cars in service, resulting in smoother operation and a considerable reduction in detonation.

Where detonation is present, check up on the magnetos and see that they are properly timed and synchronized. Also make sure that the power plant is not overloaded on account of excessive trailing load.

Maintenance Policy and Organization

The success of the Burlington in using gas-electric rail equipment may be attributed to its general policy of effective inspection and maintenance. The car inspection and maintenance forces are all on the mechanical-department payroll, reporting through their respective foreman, master mechanic or shop superintendent and superintendent of motive power to the vice-president of operation. Co-operating fully with the mechanical department, and also reporting directly to the vice-president of operation, is a rail motor car supervisory organization, comprising a superintendent of automotive service, general field supervisor and four district supervisors, who are responsible for the condition and satisfactory performance of automotive equipment on the road. In addition to instructing and training maintainers and enginemen, this supervisory organization keeps records of individual car performance, decides when cars need shopping for heavy repairs and passes on the quality of repair work done at the shops.

The superintendent of automotive service makes recommendations regarding the details of new gas-electric car specifications, repair operations, tolerances, standards, etc. The district supervisors have access to the shops and inspection points to see that the work is properly carried out and inspect and pass on all repair work before the cars are delivered to the transportation department.



Gas-electric car undergoing heavy repairs at West Burlington shops—The engine and generator are removed

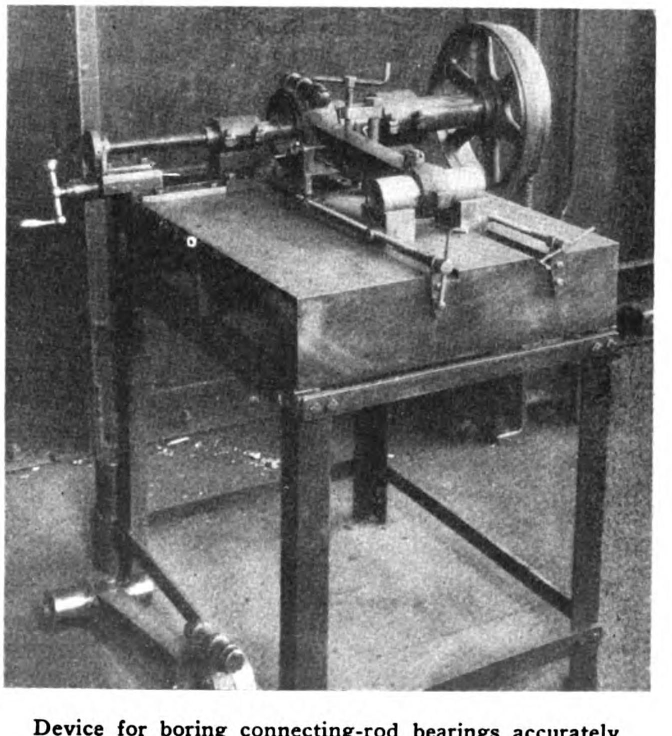
The advantages of this supervisory organization, as developed on the Burlington, include a centralization of responsibility for the proper inspection, maintenance, distribution and assignment of gas-electric cars; direct action in case of emergency; district supervisory force unhampered in determining facts and reporting them; consequent prompt correction of any undesirable conditions, and the tendency to assure a consistently high standard of inspection and maintenance work.

Three printed forms, or reports, only are used in connection with the rail motor equipment on the Burlington. No. 1659 is a maintenance record card, 8 in. by 9½ in., carrying on one side instructions regarding the details of 24 important operations in connection with rail-car maintenance. In general, these directions govern the frequency of inspections, lubrication and mechanical attention, and, under each, space is provided to enter the date, condition of work done, and initials of the employee performing the work. This card, which carries on the back a record of daily battery inspection as well as complete directions regarding the kind of lubricants to be used on various parts of the rail cars, is carried in a holder in the cab for the information of district supervisors or other interested officers who can tell at a glance just what kind of attention important parts of the car are receiving. At the end of the month, the car is forwarded to the supervisor of automotive service.

Daily work required on this maintenance record, besides testing the gravity and flushing batteries, includes checking the oil level in traction motor bearings and greasing the pump shaft. Bi-weekly operations include greasing the generator bearings and oiling the air compressor. Weekly work includes adjusting valve tappets, cleaning controller contactors, checking oil pipes, teasing journal and traction motor packing, cleaning magnetos, distributors, spark plugs, etc., and checking the entire equipment for loose bolts. Twice a month it is necessary to clean and check the generator, exciter, traction motor, commutators, brushes and holders.

Monthly, it is necessary to check and clean the carburetor screen and nozzles, grease the centerplates, and check the throttle, air starter and all wiring connections. Certain operations are performed on a mileage basis. For example, the engine oil is changed every 1,500 miles, gears lubricated, engine bearings examined, magnetos oiled, etc. Every 12,000 miles, the crank case is washed out with kerosene, and every 20,000 miles, the waste is removed from the traction-motor armature and axle bearings. The oil in the air compressor is changed every six months. Certain other operations are done when necessary, including the inspection and renewal of water-pump packing and draining and washing out the radiator.

A weekly statement, Form 1661, showing cars held out of service for repairs, is made by the master mechanic and sent to the supervisor of automotive service, with a copy to the superintendent of motive power. This statement gives a current report of the condition



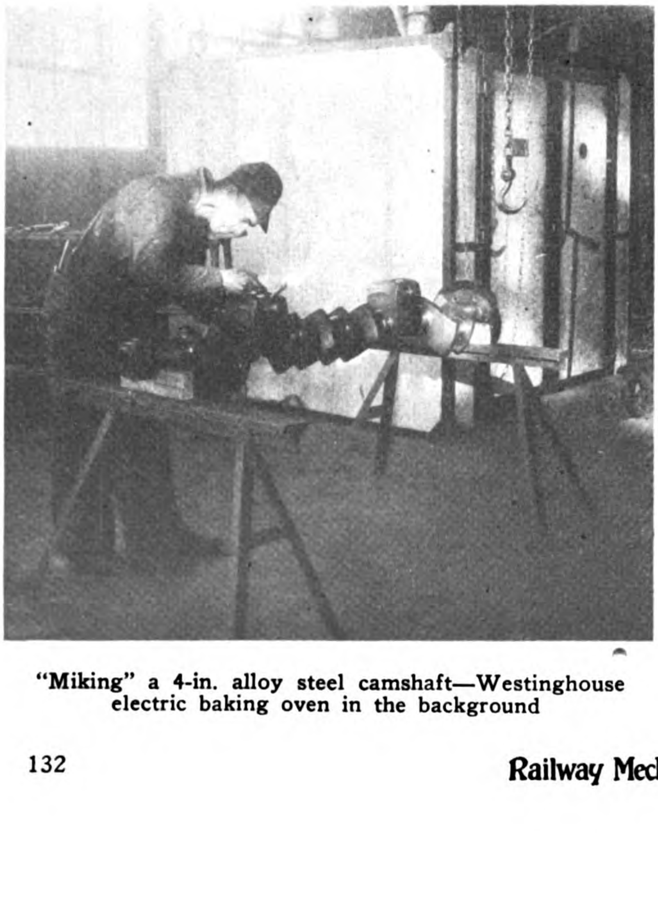
Device for boring connecting-rod bearings accurately positioned and square with the pin

of cars and also affords a record of failures, time lost, etc. The bottom part of the report is devoted to a list of material needed for the maintenance of power rail cars and is of great assistance to the stores department in assuring the prompt delivery of material.

The third report, Form 1660, is an inspection report made monthly by the district supervisor for each car in service and shows the result of his inspection of 20 important details. The nature of any repairs necessary during the month are recorded, as well as the name of the maintainer who did the work. This report is mailed to the office of the supervisor of automotive equipment, with a copy to the division master mechanic for his information. A supplementary work report is also made out by the district supervisor in advance of all general shopping of cars. The general policy of the Burlington in regard to shopping for heavy repairs is to keep the cars in service until the cost of running repairs becomes excessive and the engine and electrical equipment requires a thorough overhauling. The mileage may vary between 150,000 and 230,000 accumulated in a period of 18 months to two years, depending upon the severity of the service and track conditions on the divisions where the cars operate.

The most severe service in a gas-electric car is sustained by the prime mover and, about one month before the supervisor of automotive service determines from reports that a general overhauling of the power plant and car is desirable, the mechanical department is notified of the desired shopping date, with a copy to the transportation department, which arranges for replacement of the car and its movement to the shop. The mechanical department is also given a detailed report of the work necessary and the material needed for replacement or repairs. A copy of this report is sent to the stores department sufficiently in advance of shopping of the car, thus assuring minimum delays on account of waiting for material.

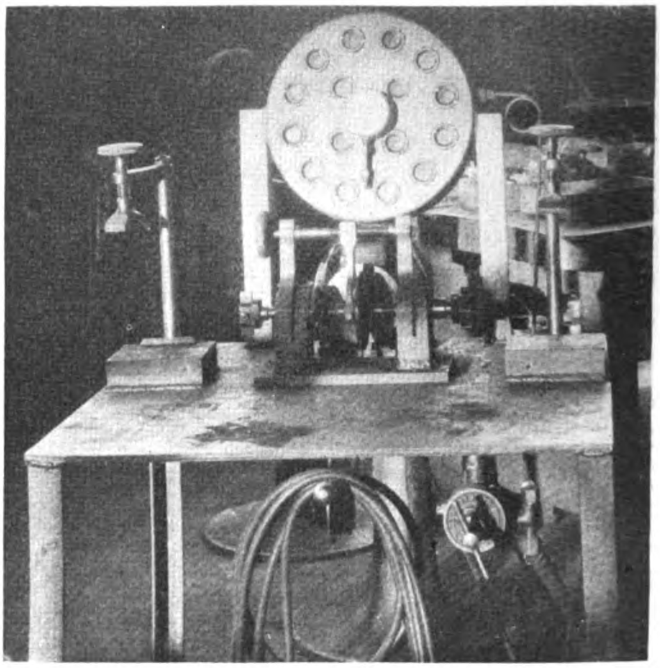
About 42 of the gas-electric cars operated on the Burlington are given heavy repairs at the West Burlington (Iowa) shops on Lines East and 15 at the Havelock shops on Lines West. At West Burlington shops, these cars are handled one or two at a time on a 10-day schedule, working the following specialized force on two eight-hour shifts daily: Five machinists, two pipe fitters, one electrician, one truck man, one helper and one car man days, and one machinist and two helpers nights. Their work is directed so that two shifts will work on those operations which take the longest and prove the limiting factor in the length of the shopping. Work on the rail cars is segregated, the cars being run in on a track adjacent to the corner of the shop where all gas-engine and electric repair operations are carried on. The only special equipment required for this work, aside from special jigs and devices used in machine operations, is a mono-rail trolley and chain hoist for handling the engine, and a Westinghouse electric oven for baking various parts of the electrical equipment.



"Miking" a 4-in. alloy steel camshaft—Westinghouse electric baking oven in the background

How Heavy Repairs Are Handled

When a car is taken in the shop for overhauling, the power truck and all power equipment in the engine room are removed, thus affording opportunity for complete inspection and overhauling without being cramped



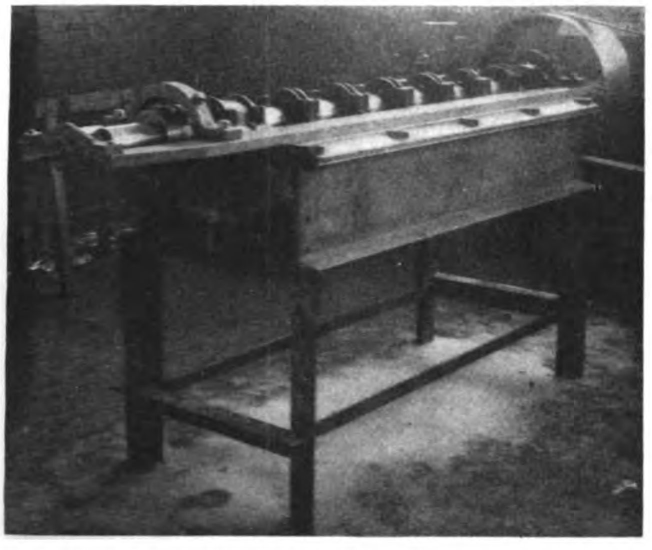
Magneto testing device used at West Burlington shops

for room. One machinist and one electrician disconnect the generator cables and remove the exhaust pipes and shrouds, as well as the piping and throttle assembly. This takes about two hours, being done by the night shift. The day gang then removes the engine base bolts, jacks up the engine, pushes it on rollers out to a platform where it can be picked up by the crane and delivered on the shop trailer to the gas-engine repair gang.

The engine is entirely dismantled so that all parts may be inspected for wear and defects. The four-inch alloy-steel crankshaft is calipered for wear and a record kept, bearing surfaces being refinished by turning if cut or more than .006 in. out of round. It has not been necessary to set a wear limit yet, in view of the fact that these cars are still comparatively new. The crankshaft is swung in an engine lathe and tested with a portable micrometer gage for straightness.

Cast-iron cylinder liners, $7\frac{1}{2}$ in. in diameter, are

measured with inside micrometers. In case of excessive wear, it must first be determined whether this is on the piston or the liner. If the liner is out of round or worn in excess of .012 in. a new liner is applied, being pressed in on a rubber gasket to assure that it is watertight and held down by the cylinder head. It is planned in the future to grind the liners in step sizes by .040 in, for oversize pistons. It is also planned to refinish worn pistons by grinding and use them with new undersize liners. In this way, two wear periods will be secured from all liners, as well as all pistons. It is seldom possible to make any reuse of the piston rings. Rod bearings are checked for size and alinement, only .030 in. sideplay being permitted, and all bearings closed and rebored to .004 in. play.

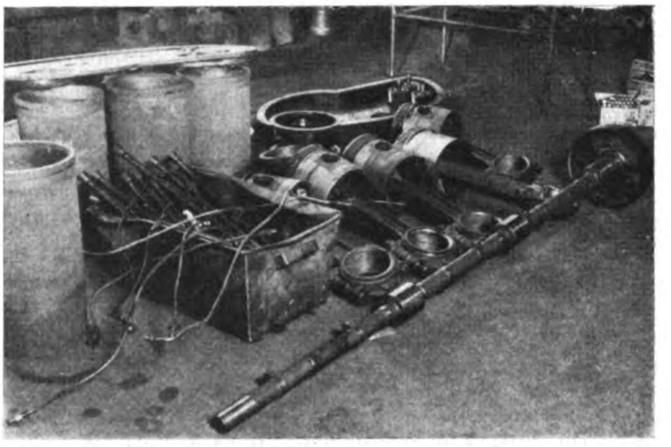


Boring bar for finishing main crankshaft bearings in accurate alinement and in a fraction of the time required by hand scraping

Main bearings are handled in the same way as it is found that a fitting closer than .004 in. tends to promote hot bearings and attendant difficulties.

The cylinder heads are examined for cracks and defects, water jackets cleaned in a lye vat and washed out with a 10-per cent solution of muriatic acid. A soda-ash rinsing water is then used to neutralize the acid. Cracks between the valve ports are welded with the oxyacetylene torch, using a cast-iron welding rod. In cases where the valve seats (exhaust) are beaten into the head, owing to excessive temperatures, alloy-steel seats are inserted by counterboring and setting them 1/32-in. below the surface of the head, which is subsequently peened over. Valve-stem guides are checked and allowed .012 in. clearance on the exhaust and .008 in. clearance on the intake valves. The valve guide bushings are renewed if necessary. Valve springs are checked for tension and length and are rejected if less than 4⅜ in. or over 4¾ in. Valves are checked for straightness and, if necessary, heated and straightened in a special jig. All valves are ground in, using a Valvo grinding machine, until the outer edge is within 1/32 in. of the top of the valve, when the valve is scrapped. Difficulty is seldom experienced due to valve-stem wear. When the valves are scrapped, the stems are used to make chisels and are in great demand for this purpose by shop men.

Rocker-arm bushings and shafts are renewed. The camshaft is checked for wear; also the bearings. Tim-



Camshaft, pistons, connecting rods, cylinder liners, etc. removed from a gas engine

ing gears are checked and renewed if they will not go another shopping. The water pump is dismantled and the packing renewed; also the shaft, if necessary. The oil pump is dismantled, inspected for wear and air leaks. The crank case is thoroughly cleaned, sandblasted and painted on the inside. Oil feed lines in the engine base are tested and welded if necessary, to assure tightness. The engine is then reassembled with new gaskets throughout. The exhaust manifolds are checked for warping and, if necessary, ground. Roller plugs and bushings for the valve lifter are checked. The indicating micrometer is used on the flexible coupling between the engine and generator to line up the armature shaft with the engine crankshaft.

Electrical Equipment

The generator is thoroughly cleaned and painted with an insulating varnish. The commutators are turned down, if worn. Windings of armature and fields are given insulation tests, as are those of the fan motor and air-compressor motor.

Traction motors are dismantled, cleaned with gasoline or tetro-carbonchloride and the armature thoroughly dried for four hours at a temperature of 200 deg. F. The armature is then removed, dipped in a baking varnish and allowed to drain for two hours, then being put in the oven and baked for 12 hours at 200 to 250 deg. F. The commutators are turned and undercut with an electrically driven machine or undercutter. Armature shaft bearings are examined for wear and usually require renewal. The field coils are varnished, dried and reassembled. All electrical equipment is inspected and cleaned. The magnetos are removed and tested for strength with a Wiedenhoff instrument, magnets being recharged and brought back to normal strength. Storage batteries are tested, inspected, and, if defective, sent to Aurora for repairs. In overhauling the cars, all wiring is tested for grounds, and approximately 90 per cent of the ignition wiring is renewed.

Trucks are thoroughly overhauled, new bushings and pins being applied where necessary, as well as springs and wheels. The roller bearings are inspected, cleaned and wicks applied. The air equipment is thoroughly cleaned and tested, as well as the heating plant. The car body is overhauled, cleaned and painted, if necessary, and the power unit reapplied in the car. The generator is connected to the traction motors and controllers, the worn contacts of the latter being replaced, if necessary.

Special Devices and Fixtures

One of the most valuable devices used in connection with the overhauling of gas engines at West Burlington shops is a boring bar for the main bearings. The bar, itself, is 3 in. in diameter, the bore of the bearing being 4 in. The bar is supported on a frame and is belt-driven from an electric motor mounted on a small truck. The bar is adjusted by four set screws in the brass-lined housing. The tools are adjusted by cap screws and set firmly. Being without micrometer adjustment, it is necessary to grind the cutters in an engine lathe equipped with a small tool-post grinder. The feed is arranged so that once the bar is set up, all bearings are bored at the same time, thus assuring an accurate alinement. It takes approximately one hour to grind the cutters and eight man-hours to bore the bearings, including the set-up time, the only additional work necessary being the scraping off of tool marks. Formerly, 80 man-hours were required for the scraping operation. An accurate alinement of the bearings is thus assured in substantially less time than by the former method.

The method of boring connecting rods is shown in one of the illustrations, this operation being performed in 1½ hours, as compared with 5 hours formerly required for scraping. The construction of the machine is illustrated. The piston pin is lined square with the body of the machine and the boring bar by means of adjustable V-blocks. Elevating screws are then properly adjusted and clamping screws tightened, the bearing being bored with a two-point cutter, which is a taper fit on the shaft. Again, a more accurate job is secured in a fraction of the time formerly required.

The valve grinder is equipped with chucks for different sizes and grips the valve at two points, thus assuring a valve seat bearing which is square with the spindle. Approximately five minutes per valve is required for grinding.

The magneto tester illustrated is provided for checking clockwise and counterclockwise magnetos used with each engine. The tester is mounted on a sheet-metal table and consists of a friction-disc speed control, clamping arrangement for holding the magnetos and specially-designed head for testing distributor heads under actual working conditions. This head has 16 spark plugs in the back, with lubricator glasses which permit seeing each spark plug while in operation under air pressure up to 60 lb. The testing is carried on with a gradually increasing pressure to 60 lb. to make sure of satisfactory operation under normal conditions. The test is carried on for approximately 30 minutes and any magnetos not showing the desired results are returned to the repair shop for repairs and replacement. Spark plugs are examined and, when the points are burned, the plugs are sent to Aurora for reclamation.

Special Work Called for During General Shopping of Gas-Electric Car No. 9728

Put unions on oil pipes on front end of engine
Renew rocker arm bushings and shaft
Renew cylinder liners, pistons and piston rings
Renew all engine gaskets
Test main oil pipe in crankcase for leaks
Clean gas filter and carburetor
Test magnetos
Adjust all engine bearings
Examine roller plugs and bushings
Examine timing gears
Clean out all oil pipes
Examine oil pump
Clean water jackets
Clean and paint inside of crankcase
Reseat engine valves
Examine starting motor
Test motometer, or thermometers
Install water carburetor
Rebush magneto and water pump coupling
Repack water pump
Examine governors and set speed to 1,050 r.p.m.
Examine crankshaft bearings for out of round
Stop all exhaust leaks
Examine throttle for wear
Clean out water space in cylinder heads

TRACTION MOTORS

Turn traction motor commutators
Varnish armatures
Examine motor bearings
Clean field coils and paint them
Reseat brushes
Examine motor leads

ELECTRICAL EQUIPMENT

Clean and test all electrical equipment
Test all wiring
Turn exciter armature
Sand main generator commutator
Examine fan motor
Examine connections on back of switchboard and solder
Renew exciter field resisters
Clean compressor motor
Clean, test and charge batteries
Test voltmeter
Oil fan in mail room

CAR IN GENERAL

Clean air and test
Examine all brake rigging and repair where needed
Clean both trucks
Examine all wheels and turn if necessary
Install in engine cab, water tank for water carburetor
Examine flange oilers and renew parts if necessary
Test all gages
Renew elliptic springs on front truck
Examine spring hangers; rebush if necessary
Examine all brake pins
Examine drawbars
Overhaul air compressor
Put oil cooler on top of car

Stug System of Firing Pulverized Fuel

(Continued from page 119)

pipes toward each burner, and on its way mixes with the coal dust conveyed by the worms. The air pipes, which terminate at the burners on the locomotive, are made flexible between the engine and tender by means of ball joints and stuffing boxes, and this arrangement has stood the test of actual service. The air speed in the pipes varies between 50 and 150 ft. per sec., more or less, according to the output of the locomotive.

The conveyor screws are driven by a small fast-running steam engine, which also operates on saturated steam. It is of the three-cylinder uniflow type, with inside admission piston valves, its speed being controlled by varying the degree of cut-off. A governor prevents the maximum speed from exceeding 500 r.p.m. The steam engine is geared to a small fan which supplies the combustion air to the auxiliary burner.

Admission of fuel to the main burners is controlled by varying the number of revolutions of the steam motor (within a speed range of about 1 to 5), and consequently the worm speed and the quantity of fuel coveyed by the worms. The same applies to the supply of air, which is regulated by varying the number of revolutions of the blower or throttling the admission of air. All of the controls are so interlocked as to make them foolproof. Thus the worms cannot be started before the blowers are set to work, and vice versa, so that clogging of the tubes with coal dust can never occur. When the locomotive is worked at less than half its full output, one of the burners is cut out. The nozzle plate of the idle burner is kept cool by a small air current being allowed to pass through it.

[Part II of this article, which will be the concluding installment, will appear in the April issue.—EDITOR.]

ONE HUNDRED YEARS AGO.—Cooper's "Tom Thumb" locomotive, built in America for experimental purposes, was tested on the Baltimore & Ohio on a 26-mile round trip run between Baltimore and Ellicott Mills on August 28, 1830. This trip demonstrated the practicability of the steam locomotive.

A Fight For Your Jobs

ONE of the proposals in the program of the Association of Railway Executives set forth on this page last month, for the accomplishment of which the railroads have united, is "a withdrawal of government competition both through direct operation of transportation facilities as well as indirectly through subsidies." This applies particularly to waterways.

Waterway advocates have for many years been active in endeavoring to commit the United States government to a vast program of inland waterways development, including the construction of canals and the construction of locks and deepening of channels in rivers. These advocates claim that the cost of transportation would thereby be reduced because of the lower rates which can be charged by the agencies operating on public waterways. While these waterways serve directly a relatively small, although economically important, proportion of the area of the United States, it is proposed to spread the benefit of the lower water rates to the entire public by the development of joint rail-water and rail-water-rail routes and rates.

The Inland Waterways Corporation, owned and operated by the United States Government, was created by act of Congress in 1924 to conduct a common-carrier water-transportation service on the Mississippi and Warrior rivers to test the practicability of the development of private common-carrier operation on inland waterways. The intention of Congress, as set forth in the statute creating this corporation, was that the government should turn the corporation over to private hands as quickly as it could be made sufficiently self-supporting. Under the Denison Act, passed by Congress in 1928, railways are required to enter into joint route and rate agreements with water carriers and the Inland Waterways Corporation is now enjoying the benefit of such routes and rates, in direct competition with the railroads in its territory.

What is the economic basis for the success of the inland waterways, in the creation of which, the government has spent many millions of dollars, in their competition with the steam railways? It lies in the fact that the government pays a large part of the total cost of transportation on these waterways and passes it on to the tax-paying public. This situation is illustrated by the Ohio river system which was completed and placed in operation between Pittsburgh, Pa., and Cairo, Ill., in 1929, after an expenditure for the construction of locks and deepening the channel of $103,630,000, with an additional $26,000,000 required for maintenance and operating costs during the construction period.

The direct cost of shipping on the river—all that has to be covered in the rates to the shipper—is about 4 mills per ton-mile. But this waterway annually costs the federal government over four million dollars in interest and about four million dollars more in maintenance and operation of canals and locks, dredgings, etc.—over eight million dollars altogether—which is equivalent to 5.42 mills per ton-mile on the traffic carried. Including, therefore, this hidden cost which the tax-paying public has to pay, it costs 9.42 mills per ton-mile to move traffic over this route as compared with less than 9 mills per ton-miles on the average for a number of railroad lines in this territory. Furthermore, when account is taken of the large increase in the number of ton-miles required to move a ton of freight between two points by water as compared with the number required to move a ton of freight between the same points by rail, because of the winding course of the river, the uneconomic character of the water transportation becomes much more evident.

Most of the traffic is in the hands of industries operating for their own benefit. The public is thus taxing itself in order that it may present to these private shippers one half of their transportation costs. Would it not be cheaper to accomplish this, if it is what the public really wants, by subsidizing the railroads?

Essentially the same situation exists on all other inland waterways which have been artificially created. The true cost, including interest on the investment in and maintenance of the waterways, as well as the expense of boat operation, in every case exceeds the cost of similar service by rail. In the case of the Erie barge canal, owned by the state of New York, the total ton-mile costs—the boatmen's charges plus the costs borne by the state—are nearly twice those charged by the eastern railways.

Aside from the government-owned Inland Waterways Corporation, most of the transportation on inland rivers is privately conducted for private benefit. Surely the railroads are acting in the public interest when they ask for legislation which, among other things, will provide the "opportunity for the railroads to enter this field of transportation under proper supervision but without handicap as compared with other transportation agencies." It is only through such operation, if at all, that the co-ordination of water and rail transportation can be effected.

Railroad men are as much a part of the public as farmers, industrial shippers or any other group. In any discussion of waterways in their communities, let them insist that recognition be given to the hidden costs as well as to the rates charged by water transportation agencies. A general recognition of the true situation will do much to stop this waste of public money on measures which are bound to weaken the railroads and seriously impair their future public service.

EDITORIALS

Safety Valves And Safety

The following question was recently received in the editor's mail: "What are the duties of an engineer when setting a safety valve?".

If there are enginemen who still believe what this question implies, then it is of such serious import, not only to these men themselves, but to all railroad officers, that it should be answered in no uncertain terms. An engineman has absolutely no business tinkering with a locomotive safety valve. The responsibility for the inspection and proper functioning of safety valves is the job of the enginehouse and shop forces. The engineman's duties with respect to defective and inoperative valves should be covered in his instructions. If he obeys his instructions, he will leave them alone.

Slugging Welds

To what extent is the slugging of welds practiced? This practice which consists of placing ends of welding wire, slugs from a punch press, or miscellaneous bits of steel on the surface, or in the hole or V, of the weld and then welding around and over them, is one that should be carefully guarded against. If the weld is a flat surface and is to be machined, the tool of the machine is more than apt to catch in the slug and tear it out of the weld, with an occasional breaking off of the tool. If it is a hole that has been welded and slugged, it is apt to result in broken drills if a hole is to be drilled adjacent to the weld, which is often the case.

In any instance, the slug does not represent a completely welded job and the weld is weaker for it being there. There is no doubt that the practice speeds up the production of the welders, which is advantageous to them if they are employed on a piecework basis. But the advantages stop there. There is no gain or profit in a slugged weld. There is no extension of life of the welded piece. Quite to the contrary, the life of the welded piece is liable to be greatly diminished with the chances favorable for a failure in service.

The Advantages of Temperature Control

One shop process in which the railroads have fallen behind, in comparison with the progress which has been made in other industries, is the heating of metals. In the development of autogenous welding, on the other hand, the railroads have been leaders. This process greatly simplifies many repair operations and has made possible the mending of expensive parts which otherwise would have required replacement. Its application is flexible and it is, therefore, especially adapted to repair-shop operations. Refinements in heat treating most readily adapt themselves to operations for which a systematically conducted routine may be developed and find their most obvious application in production industries.

But that the results of accurate temperature control fully justify the installation of the equipment necessary to effect it in many heating operations in the railroad shop is demonstrated by the results obtained in the Norfolk & Western shops, set forth in an article in this and our preceding issue. This is not primarily because of the cheapening of the processes themselves, but because the resulting uniformity in quality of materials has effected increases in life and a reduction in the volume of work passing through the shop.

This demonstration of the economic advantages of accurate temperature control on materials now in use opens up possibilities for a more extensive application of special steels, the use of which has been retarded by the general lack of facilities and methods for properly dealing with them in the shops.

Individual Versus Group Drives

Practically all of the more modern shops and engine terminals, especially those built in recent years, have been equipped with machine tools having individual-motor drive. However, the question of the economy of individual drive as compared with drives of machines in groups from a single motor of larger capacity was brought up at a recent meeting of the Machine Shop Practice Division of the A.S.M.E. One of the speakers pointed out that 50 two-horsepower motors could not deliver power nearly as efficiently or at as low cost per horsepower as one 100-horsepower motor. He said that his plant had scrapped its individual motor drives at about one-half their value and had purchased large motors to drive groups of machine tools. It was estimated that the new investment would pay for itself in approximately a year and a half.

The wisdom of such a move is, of course, open to argument. Individual-drive motors possess certain advantages which the group-drive motor does not possess. If a machine tool or its motor fails, only one unit is affected. As is frequently the case in railroad-shop practice, the services of all tools are not required all the time. There is no economy in driving one tool with a motor having the capacity to drive a group of ten or a dozen. There is also the upkeep in maintaining belts, drive shafts, pulleys and safety guards which must be considered in connection with group drives.

However, there are departments such as the automatic machine-tool or manufacturing departments in a machine shop where all the tools are in continual operation. In such instances, it might be advantageous to investigate the merits of group-drive as against individual-motor drive.

Railroad Representation On the A. S. A. Council

The announcement in the January, 1931, bulletin of the American Standards Association that L. A. Downs, F. H. Hardin and L. K. Sillcox have been appointed members of the A.S.A. Standards Council is of inter-

est to all mechanical department officers. Mr. Downs, president of the Illinois Central, is to represent the American Railway Association; Mr. Hardin, assistant to the president of the New York Central, represents the Mechanical Division, A.R.A., and Mr. Sillcox, vice-president of the New York Air Brake Company, represents the American Society of Mechanical Engineers. The latter is a member of the Executive Committee, Railroad Division, A.S.M.E., and has been active in the research and standardization work of the society for a number of years.

The work of the American Standards Association has been of increasing importance in the industrial life of this country for many years. The association is composed of forty-five member bodies, which includes seven governmental departments, practically all of the various technical societies, and a considerable number of industrial associations and corporations. The member bodies contribute both funds and technical talent to the work of the association.

The objects of the American Standards Association are to provide a systematic means of co-operation in establishing American standards to the end that duplication of work and the promulgation of conflicting standards may be avoided; to serve as a clearing house for information on standardization work in the United States and foreign countries, and to act as the authoritative American channel in international co-operation of standardization work.

The action of the American Railway Association in joining with other industrial associations and engineering societies in sponsoring the work of the A.S.A., marks an advance step which is in conformity with the trend toward co-operation in matters of common interest among all industries.

Defect Carding For Damaged Sheathing

The new American Railway Association interchange rules, as amended effective January 1, 1931, contain perhaps no more welcome change than that covered by Rule 4 with respect to the damaged sheathing of refrigerator cars. The previous reading of this particular rule, which was no doubt experimental, led to much controversy and unnecessary carding. Parts of refrigerator-car sheathing, bare of paint because of some slight friction, apparently could not be construed as a serious defect with any bearing on safety of operation. A great many car owners were not repairing such defects, some of which, consequently were of long standing. A rigid enforcement of the letter of the rule, therefore, often resulted in penalizing a railroad which had not caused the original damage to the sheathing. The new wording of this part of the rule will undoubtedly bring immense relief to all interchange points and be a most welcome change. The indications are that maximum benefits from this amendment to Rule 4 are not yet being secured because supervisors have failed, in some instances, to see to it that interchange inspectors are properly instructed in the revised wording and intent of this part of the rule.

In connection with carding for damage caused by a delivering line, Rule 4 seems to be clear that a defect card should be applied to the car at the time and place of damage, or as soon thereafter as possible. But, this is not always being done. Too often, it is left up to the receiving line to demand a defect card and, if they fail to notice the damage, the delivering line is that much ahead. This seems to be the line of reasoning, when, as a matter of fact, no railroad or individual gains in the long run by any such practice. This rule is just as mandatory as any other, and, in these days, especially when payrolls are being reduced, involving the taking off of many receiving inspectors, it is not fair to leave the detection of the damage and the request for a defect card up to the receiving line.

It is a good plan to institute the practice on every railroad to attach the defect card to foreign and system cars for unfair damage immediately at the scene of the accident, because if the car does not leave the line but reaches the repair track, the presence of the defect card on the car tells the repair track foreman the story and much tracing is avoided. Should the car reach an interchange point for delivery off the line, the defect card is attached and the car moves through without burdening the inspectors at that busy point.

Locomotive Fuel Records

Along with many other problems which confronted railroad mechanical departments in 1930 was the necessity of bending every effort to conserve locomotive fuel, and, to the credit of the railroads as a whole, it may be said that satisfactory fuel performances were secured, in spite of a general decline in traffic, which had a very adverse effect on unit fuel consumption figures.

An excellent record was made on the St. Louis-San Francisco, for example, as outlined by Robert Collett, fuel agent of that road, in a recent article published in the Frisco Employees' magazine. Definite objectives are essential for the best results in any line of endeavor and, for 1930, the Frisco set out to obtain a record of 166 lb. of coal for 1,000 gross-ton miles in freight service, 14.5 lb. per passenger car-mile in passenger service, and 140 lb. per switch locomotive-mile in switching service. The actual performances in these three particulars were 163 lb., 15.2 lb. and 144 lb., respectively. The goal was more than reached in freight service in spite of the decline in business, and was credited to the use of generally more efficient modern power and the continued lively interest in fuel economy by officers and employees generally, including enginemen and firemen whose efforts have such a direct bearing on the conservation or waste of locomotive fuel.

While the fuel performance goal was not quite reached in passenger and switching service on the Frisco, the 1929 record in each of these classes was equalled, and Mr. Collett explains that this performance was particularly gratifying and really more of an improvement than the figures indicate because, in passenger service, for example, fuel consumption is calculated on a car-mile basis, and the average number of passenger cars per train decreased slightly, while their average weight increased. Similarly, in yard service, the switching locomotive-mile is based on an arbitrary six

Unit Locomotive Fuel Performance on the Frisco

Year	Lb. per 1,000 gross ton-miles	Cost per 1,000 gross ton-miles
1920	255	0.512
1921	239	0.482
1922	240	0.435
1923	233	0.403
1924	200	0.329
1925	187	0.314
1926	177	0.287
1927	176	0.266
1928	175	0.249
1929	170	0.225
1930	163	0.212

miles per hour, and Frisco switchers did more work per unit in 1930 than in 1929. This is indicated by the fact that switching locomotive-miles decreased about 13½ per cent, while the total freight business decreased only 12 per cent. As a matter of interest, the unit locomotive fuel performance of the Frisco during the past ten years is shown in a table which indicates a decrease in 1930, as compared with 1920, of 36 per cent in pounds per 1,000 gross ton-miles, and 58.6 per cent in cost per 1,000 gross ton-miles.

Considering the railroads as a whole, unit locomotive fuel consumption has now been reduced to a point where additional economies are increasingly difficult to attain. The question of the feasibility of still further improvements, however, is answered each year by the establishment of new records. If these records appear to be only a slight improvement over the previous year, a better perspective can perhaps be obtained by comparing them with the performance ten years previous and remembering that, without the continued interest of railway officers and employees, stimulated by an active and aggressive organization of fuel specialists, it will be very easy to slip back and lose in a short time much of the ground gained by years of patient effort.

Freight Cars Grow Heavier

For many years the trend in the weight of freight cars has been steadily upward. While the fact itself has, no doubt, been generally recognized, little attention has been paid to its import.

Perhaps the reason for this may be found in the fact that the loading capacity has increased almost in exact proportion to the increase in weight. This has held true with but slight variations during the past eleven years. In 1920 the average weight per car of the cars actually moved in trains on the Class I railroads was 20.1 tons. In 1930 the average weight per car moving in trains was 22.2 tons. Within the same period the average capacity of freight cars had increased from 42.4 to 46.6 tons. Assuming that these cars were loaded to capacity, the tare weight in 1920 averaged 32.2 per cent of the gross weight. In 1930 this ratio was 32.3 per cent—an insignificant difference.

But a relatively small proportion of the loaded cars moving in trains are actually loaded to capacity. Consideration of the average car load instead of the capacity load places a different aspect on the situation. Throughout the past eleven years there has been an almost continuous downward trend in the average car load and there is little reason to anticipate any change, unless the railroads are to allow a considerable proportion of their merchandise loading to be taken over by highway trucks. In 1920 the average car load was 29.3 tons and the average tare weight was 40.7 per cent of the gross weight of the loaded cars. In both 1928 and 1929, with the average load of 26.7 and 26.9 tons per loaded car respectively, the tare weight was practically 45 per cent of the total weight in each case, and, with an average load of 26.6 in 1930, it had increased to 45.5.

These ratios, which represent the average effect of increasing weight and decreasing average car load on the operations of the Class I railroads of the United States as a whole, suggest that more attention needs to be given to weight in designing freight cars, particularly box cars, if the gross ton-mile burden of producing revenue ton-miles is not to continue its upward course. The problem of reducing freight-car weight is not an easy one. The demand for increasing strength and stiffness along with the demand for greater cubic capacity for handling automobiles, for instances, can scarcely be accompanied by a reduction in weight without a change in materials or a reduction in the shocks to which freight cars are subject both in switching movements and in long trains. The problem is one, however, to which serious attention needs to be given.

NEW BOOKS

Mechanical World Year Book, 1931. *Published at the office of the Mechanical World, 65 King street, Manchester, England. 534 pages, 4 in. by 6½ in. Price 1 shilling 6 pence.*

Three new sections on power-plant operation, electric railways and electric lamps and lighting, giving a full description of the latest methods and practices used in these branches of electrical engineering, have been included in the 1931 Mechanical World Year Book. Improvements have also been made in the sections on steam boilers, internal combustion engines, belt conveyors, etc.

Proceedings of the International Railroad Master Blacksmiths' Association. *Wm. J. Mayer, secretary, 2347 Clark Avenue, Detroit, Mich. 120 pages, 6 in. by 8½ in., illustrated. Black board binding.*

This book contains the full report of the thirty-fourth annual convention of the International Railroad Master Blacksmiths' Association which was held at the Hotel Morrison, Chicago, September 23, 24, and 25, 1930. The subjects discussed at this meeting were Autogenous Welding, Carbon and High-Speed Steel and Heat Treatment, Machine and Drop Forging, Spring Making and Repairing, Reclamation, and Safety First.

Sheet Steel and Tin Plate. *By R. W. Shannon, associate member American Institute of Mining and Metallurgical Engineers. Bound in cloth, 6½ in. by 9¼ in., 285 pages. illustrated. Published by the Book Department, The Chemical Catalog Company, Inc., 419 Fourth avenue, New York. Price $5.*

According to the author, this book is intended to assist the layman toward the best and most economical utilization of sheet steel products. It is not a technical book and has been prepared for the use of the practical man who is concerned with the utilization of sheet steel and tin plate. The author has done very well in clearly expressing the essential facts in everyday language and has not made the mistake of attempting to write what is generally termed, "a high-brow book." Although the book is not a large volume, the author has begun at the beginning and explained in an understandable way the underlying principles of iron and steel making, as they relate to the various forms of sheet steel and tin plate. He has explained the operations and materials involved in the rolling and treating of these products and gives a very thorough description of the nature and purpose of the numerous grades and finishes in which steel plate are produced.

The book is divided into two parts, with a total of 16 chapters and 7 appendices. Railroad mechanical department officers, especially those who are intimately concerned with the utilization of sheet metal in car and locomotive repair work, will find this book a useful addition to their reference library.

THE READER'S PAGE

An Answer to the Question on Rule 17

TO THE EDITOR:

Referring to the question in the February issue of the *Railway Mechanical Engineer,* page 84, dealing with A.R.A. Rule 17, the rule in part reads: "Defective non-A.R.A. standards may be replaced with A.R.A. standards (which must comply with A.R.A. specifications) etc." The 5-in. by 5-in. coupler shank with 9⅛-in. butt and Type D head referred to in the question does not meet these requirements.

Also, since A's car is equipped with "coupler shank, 5-in. by 5-in., with an 8½-in. butt" and is so stenciled, the application by B of a 5-in. by 5-in. coupler shank with a 9⅛-in. butt and Type D head would be wrong repairs, according to Rule 16 which reads: "Repairs to foreign cars shall conform in detail to the original construction."

J. E.

Mutual-Admiration Clubs Are of No Help to Business

TO THE EDITOR:

Allow me to make a few comments on your correspondent's letter in the February, 1931, issue under the heading "Who Belongs to This Organization."

If I knew of such an organization as the one described on the railroad with which I am connected and if I were a master mechanic, I would set about at once to bring about a complete reform to knock the conceit out of those men.

It has often been said that a little knowledge is a dangerous thing for some people and that self praise gives off a bad odor. These men of which "Master Mechanic" writes seem to have the wrong attitude toward their jobs, their duties and responsibilities toward the railroad. Perhaps they are laboring under the illusion that the railroad is being operated solely to give them soft jobs and, as the jobs are not as soft as they would like to see them, they play sore head.

Their minds must be warped and their ideas distorted due to lack of proper knowledge of their relationships to their employer. If these men should go into business on their own hook for a year or two (if they could stay in business that long), they would quickly discover the fact that they have a great deal to learn in order to succeed. They would have to take all the risk, with nobody to blame but themselves if failure should overtake them.

If I were "Master Mechanic," I would work towards arranging the subject to be discussed at club meetings. I would expect each man to pledge himself whole-heartedly to support such a program as that which was published on page 80 of the February issue entitled "A Fight for Your Job." But here it may be inferred. "How can I help the railroad to carry out that program?"

You can help a great deal. You are a legal voter, a tax payer and a citizen of this great United States. As such, you have rights, privileges and duties. Exercise them for your own good and that of your railroad as well. Instead of discussing how clever you are and how poorly managed your railroad is, how about writing to your senator, your congressman or the members of your state legislature opposing certain measures or pending legislation designed to further curtail railroad earnings, or writing relative to the unfair competition to which the railroads are subject or excessive taxation of yourself as well as the railroads. They are glad to get the opinions of the people back home, and such letters, if briefly written and to the point, will not fail to exert considerable influence in shaping the course of the government toward the railroads.

Leave the criticizing of the railroads to Arthur Brisbane. Mind your own business, which should consist of constructive suggestions given freely to your superior and at meetings of your foreman's club.

Nobody can stand still in these days of rapid progress. Those that do not move forward fall backward and eventually become deadwood to the railroad that employs them.

An organization such as "Master Mechanic" mentions has long since ceased to justify its existence and should, therefore, be entirely reformed or abolished.

L. I. BERTY.

A Tribute to William Mason

MARACAIBO, VENEZUELA, S. A.

TO THE EDITOR:

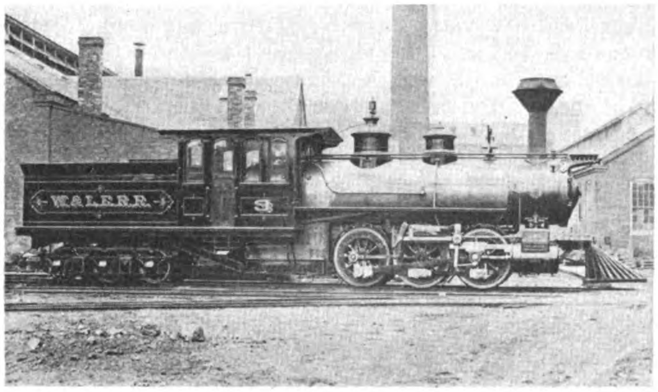
The recent death, at Taunton, Mass., of the daughter of William Mason brings to the minds of the older generation of railroad men the work of this brilliant pioneer locomotive builder. It is probable that no one man did more to bring the locomotive to its present state of near perfection than did this practical, resourceful, ingenious mechanic of a former day.

Entering the field in 1852, after several years of successful building of cotton machinery, Mason so impressed his individuality upon the industry as to bring undying fame to himself and the beautiful creations turned out of his shops. A born artist, his work had a beauty of line and proportion which was the despair of other builders of his day, and with the excellent finish and workmanship that characterized all of his productions he made a mark for others to aim at for many years.

Mason's earnest advocacy of the Fairlie, or, as he termed it, the "Bogie" type of locomotive and the Walschaert valve gear, made him looked upon as something of a crank by the early mechanical societies, but recent years have proved that he was ahead of his time. However, the cool reception given his ideas did not prevent him from building many of these "Bogies" and giving much thought to the improvement of the Walschaert gear.

The locomotive shown was built shortly before Mason's death in 1883, and it is doubtful if the performance—for its size and weight—of this locomotive and others of this type has ever been equalled, before or since. In Mason's first applications of the Walschaert gear he tried to get the radius-rod hanger as long as possible, putting the tumbling shaft on top of the boiler.

In the locomotive shown he went to the opposite extreme and made it very short, but the results obtained proved the soundness of the change. There was an exceptional slip of the block at the end of each stroke which tended to keep the steam and exhaust ports open a fraction longer at the right time and probably produced the unusual results attained.



One of the last of William Mason's designs—an 0-6-0 type with Walschaert valve gear built in 1883

The writer both fired and ran these locomotives in his early experience and often had the fireman unlatch the fire door while on a hill so as to better hear the beautiful, snappy, clear-cut exhaust of these masterly creations. Combined with the distinctive, resonant ring peculiar to the diamond stack, it made an impression never to be forgotten by one with any affection for a real locomotive.

F. M. Wescott.

Rule 4 of the 1931 Rules of Interchange

New Haven, Conn.

To the Editor:

I would like to get the opinion of some of the readers of the *Railway Mechanical Engineer* in regard to the following A.R.A. interchange rule.

Rule 4, Sec. J, states in part "Joint inspection, within 90 days after first receipt of car home, may be made by representative of car owner and a representative of a disinterested railroad, or by a chief interchange inspector."

If this rule is to be applied as written, it will work a hardship in some cases, if a car is interchanged with the owner at a point where the latter has no inspector and the car travels 50 or 100 miles before an inspection is made and it happens to be located about the same distance from a foreign connection. Under such conditions it would be impracticable to have a distinterested inspector make an inspection where the car owner found that a car had additional concealed defects.

I should think under such conditions if damaged parts were concealed and directly associated with those damaged parts covered by a defect card, the inspection certificate would be valid, although it bore only the signature of the car owner's representative.

I really think the above to be in accord with the spirit of the rule as outlined in the preface to the code of interchange rules. It is my contention that this rule should be interpreted to have the same principle as Rule 12, second paragraph.

James W. McDonnell.

What Is Standard Side-Bearing Clearance?

To the Editor:

If one desires information on side-bearing clearance, he has to turn to Rule 4 of the A.R.A. Loading Rules since no mention is made of this subject in the A.R.A. rules governing the interchange of cars. The writer has read this rule several times and does not quite understand its meaning.

Apparently others are confronted with this problem since many mechanical officers differ as to what should be adopted as a standard or proper side-bearing clearance. They issue their instructions to cover their individual roads and these instructions are passed down to the men in the shops and to the inspectors who usually are anxious to comply with them. However, when a foreign car comes under their jurisdiction, they observe the side-bearing clearance and, if it is near the requirements, they feel that it is satisfactory to continue the car in service. If this car encounters a derailment the inspector, who failed to hold the car until the road's side-bearing clearance standards were complied with, is held responsible.

The question is: What is the proper side-bearing clearance in accordance with this one rule we have? The writer has a definite idea of what he thinks it should be: A maximum clearance of $\frac{5}{16}$ in. or a minimum clearance of $\frac{1}{8}$ in. on each truck. This should be divided equally between the two bearings or, with one bearing flush, the other bearing should have the full $\frac{5}{16}$-in. or $\frac{1}{8}$-in. clearance.

General Car Foreman.

Should the Car Owner be Responsible?

To the Editor:

An interesting repair was recently called to my attention. A foreign box car was derailed resulting in damage to a hand-brake gear box which was attached to the end sill of the car in question. The parts damaged consisted only of safety appliances, including the brake staff, gear wheels and gear box. A.R.A. Rule 33 would therefore apply and make the car owner responsible for the damage to the car. However, the man making repairs to the car had to decide whether or not a defect card was in order. In view of issuing the defect card, he wondered whether or not the car owner should be billed or should the record be marked, "no bill." He took the latter alternative and marked the repair record, "no bill" and applied a defect card for the wrong repairs made; which was necessary, not having this type of hand-brake gear box in stock.

Later, the writer learned that this repair should not have been marked "no bill" but the repairing line should have rendered a bill against the car owner for all the repairs made and attached the defect card for the improper repairs, and that when the car owner corrects the improper repairs he will be reimbursed. In addition to this being a technical question as to the proper procedure of billing, it hardly seems fair that the car owner should stand any of the expense involved in the repair or restoring this hand brake arrangement to its original condition. This statement is made in view of the fact that the car was derailed and, because there was no part of the car other than safety appliances damaged, the car owner is held responsible.

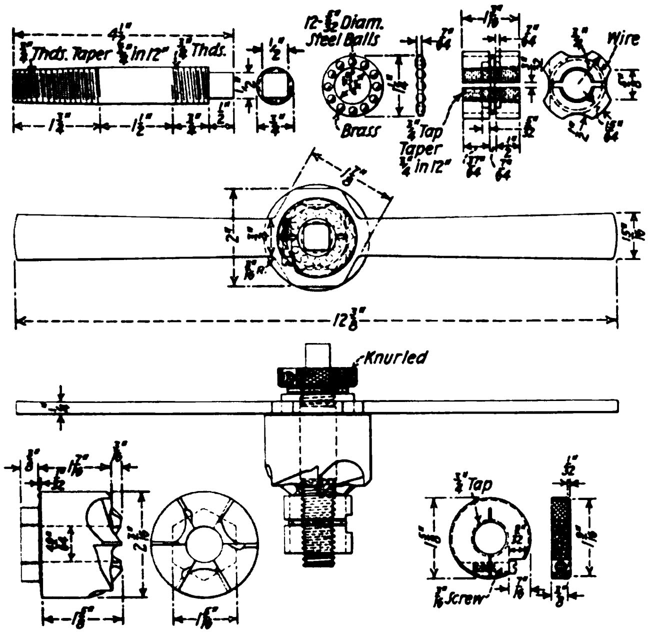
General Car Foreman.

With the

Car Foremen and Inspectors

Reamer for Car Triple-Valve Seats

SINCE it is of the highest importance that the emergency-valve seat in the check case of a triple valve be as near perfect as possible to eliminate possible air leakage from the train line into the valve, the equipment used for repairing the seat should be given careful consideration. The design of a reamer for repairing this important valve seat is shown in the drawing.



A reamer designed to reseat emergency valve seats without chattering or sticking

It consists of a six-fluted cutter mounted on a central shaft together with a knurled clamping nut, a handle and two leaders, the latter being separated by a ball-bearing race. The cutter is 2 1/8 in. in diameter and has an overall length of 1 5/8 in. The leaders, which rotate in the bushing below the valve seat while the reamer is cutting, serves to steady the reamer and to assure a perfect seat. The leaders are separated by a ball-bearing race which is made up of a brass race and twelve 5/32-in. steel balls. The leaders are of circular cross-section with four concave faces, cut with a 1/2-in. radius until the faces are 5/8-in. long.

A 1/4-in. round handle, 12 3/8 in. long is used to actuate the reamer. It is set next to the body of the cutter and is held in position by the knurled nut. When assembling the reamer, the leaders with the ball-bearing race between them are screwed on the central shaft after which the cutter and handle are mounted. A ball-bearing race is also set between the handle and the knurled clamping nut. After the nut is screwed down on the shaft until the parts are all securely mounted the knurled nut is clamped to prevent movement of any of the parts. When in use the ball-bearing races between the leaders and between the knurled nut and handle of the reamer, prevent sticking or chattering while the cut is being taken from the valve seat.

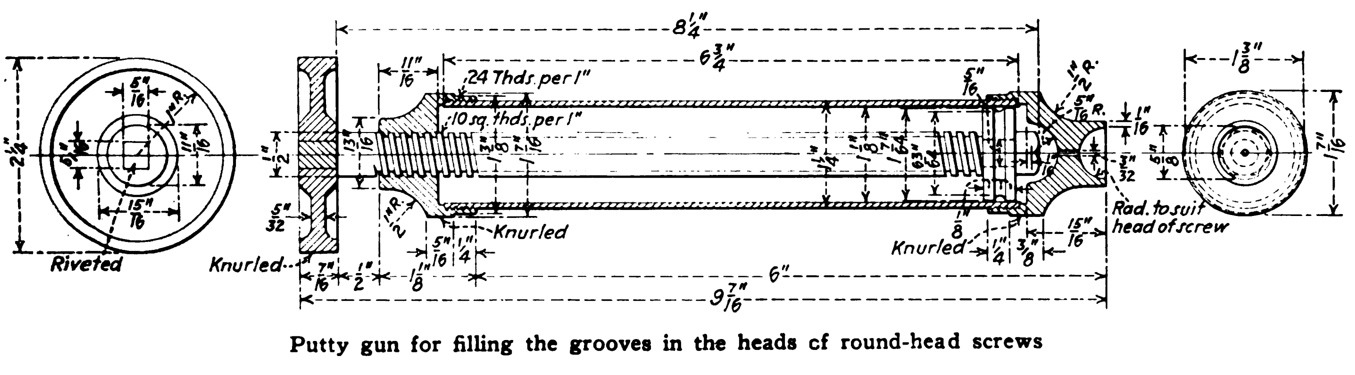
Putty Gun for Round-Head Screws

A NUMBER of roads which own or operate coaches of wood body construction in trains with all-steel equipment have found it advisable to cover the wood cars with steel plate, not only to give added strength to the superstructure but to have all the cars in a train of similar appearance. The application of the steel plate to the wood frame members requires a large number of round-head screws. This style of screw is used to give the appearance of rivets.

Filling the grooves in the heads of round-head screws with putty is a tedious task when done with a putty knife. The putty gun shown in the drawing is designed to expedite such work. It consists of a barrel made of 1 1/8-in. brass tubing. The screwcap, handle and head fittings are of stick brass. The screw piston and piston head are of mild steel. Any number of heads can be used with this gun as required for screws of different size.

The gun is filled by screwing the piston toward the screw cap as far as it will go. The head is removed and the barrel, in front of the piston, is filled with soft putty. The head is then reapplied.

To operate, the gun is placed over the head of a screw. A turn of the handle forces the putty through the 3/32 in. hole through the head and into the groove.



Putty gun for filling the grooves in the heads of round-head screws

Alec and Dave Return

By T. J. Lewis

Alec billed Dave's road for a pair of wheels with sharp flanges, believing that was the only defect, but Dave discovered the wheels had been slid flat. Dave secured joint evidence to support his contention that the handling line was responsible as per Rule 68 but Alec maintained that Rule 74 applied. The shoe was on the other foot when Alec discovered Dave's road had been the handling line with the result that each of the boys reversed his contention concerning the responsibility. What do you think about it?

IN addition to their interchange work, Alec and Dave each have a small repair-track force to supervise, just sufficient to keep up running repairs of the interchange and a light train-yard service. They do the inspecting on the first shift and have one inspector each on the second and third shifts. They check repairs and make out their billing repair cards, also defect cards when it just must be done.

The other morning as Alec was passing the rip track on his way to the interchange, he saw the repairmen arranging to jack up a car of Dave's road. Looking at the shop card on the car, he read, "worn flange, L 1". The card was signed by his second-shift inspector. Being right at the wheel, he took a look at it, put his wheel gage on the flange and found that it was "out", so he stepped over to the wheel storage track, checked and marked the wheel to be applied, pointed it out to the repairmen and went on his way, intending to check the removed wheels and axle as he returned, after it was out from under the car.

The weather had been threatening all morning and as Alec left the interchange it began to rain and by the time he reached the rip track it was coming down lively. Stooping over his record book to protect it from the weather as much as possible, he hurriedly copied the wheel numbers and dates of casting and other markings, took the axle and journal dimensions and made a dash for his office or shack, either one or both.

As Alec passed the shed where the material bins are located the repairmen were utilizing the time while it was raining to brush out the bins, sort and replace materials in their proper places, re-thread pipe nipples, gouge broken ends of pipe out of anglecocks, re-tap the anglecock threads, replace broken anglecock handles and do all manner of rainy-day jobs. He thought it would be a good time to write up his records, make out his billing repair cards and get all his office work caught up. Incidentally, among other things he did was to make out the repair bill and wheel report for the pair of wheels applied that morning to the car from Dave's road. By the time he had finished, the rain had stopped and it was nearly time for the passenger train, so he gathered up his reports to be mailed and went over to the station.

As he was leaving the passenger station, "Skippy," the call boy, came after him to go to the freight house and inspect a car which had a commodity ticket on it marked "merchandise" and which had shown a leak during the rain earlier in the morning. From there he made another round to the interchange, then took another slant over the yard, looked over the fill-out for the next Northbound freight train and arrived back at the office to make out the time tickets for the day.

Just then Dave strode across by Alec's rip track from the opposite direction and noticing a home car on it, he walked up to it and saw that a pair of new wheels had been applied. The condemned wheels still stood on the track in front of the car. The one nearest him looked like a good wheel, so he gave it a slight push and as it rolled he felt a slight vibration and heard a dull thump. Turning it on over, up came a slid-flat spot that just took his wheel gage to a hair." "Umph," grunted Dave, and mumbled "so Alec is making us a present of a pair; I know it nearly took the old boy's hide." Going over to the mate wheel, he found only a very small spot on it. "It's still strange to me," he thought, almost aloud, "never both wheels in a pair slid the same."

Alec's office being on Dave's route to his own yard, Dave stopped by to pass the time of day and leaning in the window said, "whatcha say, Alec?"

"Save your money," mumbled Alec, without looking around, then, finishing his work, he turned round and asked, "Which way, Dave?"

"Back to the works," replied Dave. "Just answered a call over to the ice plant to advise with the fellows over there about the bracing of a boiler they're loading for shipment up the road." Then: "Alec, have you ever found out why it is that the two wheels of a pair never have the same sized slid spots on them?"

"No. I never have been able to figure it out," said Alec. "Sometimes I've thought that the brake rigging had something to do with it; then, again, I decided that maybe one wheel was harder than the other; then, still again, it occurred to me that the engineer might have been working sand and one pipe was stopped up or one side flowed more freely than the other. But it may be that none of these have anything to do with it."

"I know we've talked about it before," Dave went on, "but what brought it to my mind anew was that wheel you've just removed from that car of ours out there. One slid to the gage limit and the spot on the other is not much bigger than a quarter."

Alec's interest quickened perceptibly and he said: "What are you trying to talk about Dave?" "We haven't removed any slid wheel from any of your cars. You must have been looking at the wrong wheel."

"I was looking at a slid flat wheel," Dave persisted, "and I figured it came out of our car. The wheel is standing on the track right in front of the car and both the wheels have our road's initials cast on them."

"Yes, but that is a thin flange, Dave," said Alec, "I gaged it myself and have already made out the billing repair card and its gone in. Here is my copy of the wheel report," and Alec reached the wheel report toward Dave who paid no attention to it, but said: "Well, you're wrong this time Alec, sure, because that east wheel is slid."

"No, I guess not. No man is ever wrong in removing a wheel with a flange worn as thin as that one on the west," said Alec, "and as for the other wheel being slid flat, what you say is the first I've heard of it. Anyway, the work is done and the bill and report gone in."

Dave's bristles began to rise and he grumbled "Now look here Alec, you're not going to start any such funny business as that, I know, because if you do you won't get anywhere with it, I'm telling you now."

"What do you mean 'funny business'," asked Alec, "nothing funny about it that I can see." The fact was that what Dave had said about the slid wheel had begun to soak in on Alec's mind and he was beginning to wonder to himself if he had really 'gummed the works.' Anyway, he had done an honest job and Dave need not think that his threats of him 'not getting anywhere with it' was going to affect matters in the least; he could run his own job without any of Dave's help and it was a good time to let Dave know it, so he said:

"Just save your threats Dave. I'm not trying to get anywhere with anything that I'm not already gone with, for that job is finished and I'm thru with it; but, just for your satisfaction, I'll show you what that wheel was removed for—"

"Yes," Dave cut in, "and I'll just show you what it should have been removed for—"

They had started voluntarily at the same time for the car and Alec broke into Dave's argument with:

"I'm not expecting, nor trying to satisfy everybody about this matter, Dave. I found out long ago that its impossible to satisfy everybody about any one thing and if I do things to suit myself and the company I work for I think I'll be doing very well without getting you to come over and run my job for me."

Alec's obstinacy and ill humor had not improved Dave's state of mind any and he came back with:

"Look here, Alec, I'm not trying nor wanting to run your job. I just thought you had made an honest mistake and I wanted to help you get right on it before it went any further."

"No, you didn't," Alec broke in testily, "you started in to make me get right, according to your own notion of what was right in this particular case, but here is the wheel to show for itself." They had arrived at the car by this time and Alec continued, "this wheel was removed and billed for according to the first paragraph of Rule 74 and it is a plain enough case for anybody. See, here is Joe's chalk-mark on the plate, just opposite the thin part of the flange. Now you can gage it for yourself, with your own gage, and you'll find it thin for a distance of at least eighteen inches right here."

The moment Alec stopped, Dave got started:

"That's all right Alec, that's perfectly all right, but what I'd like to know is, how it happened that neither you nor Joe heard this other wheel bumping. You could surely hear it further than you could see that worn flange."

"I've never seen the car 'til this morning," said Alec, "and when I came to work it was standing right where it is now, with this worn part of the flange turned right to me. Joe shopped it and, of course, I don't know whether he was near it any time while it was rolling or not; if he was, it seems he would have heard it if it was slid flat."

"Well, just turn it over and look right over here at this other wheel," said Dave, as he rolled the wheel until the slid spot came up. "Sure, that wheel's worn out, but what seems funny to me is the fact that you took the wheels out, checked 'em on your record, made your bill and sent it off and never did discover that you had ruined this one by sliding before you ever found that that one was worn out. Looks funny to me—sure does."

This half insinuation of Dave's that Alec must have known of the slid wheel made Alec furious. He tried to speak but couldn't, so he turned away as if to leave, swallowed hard a couple of times and came back and, looking straight at Dave, said: "That's enough of that brand of stuff, Dave,—plenty, and I don't want to hear another word of it. You're trying to make it appear that you think that I want to chisel you out of a wheel, but you know better. Ordinarily, of course, I would have turned the wheels over and inspected them both carefully when I checked them, but it was raining cats and dogs at the time, and it took all I could do to keep the rain from ruining my record book and not giving a thought to a slid wheel, I glanced at that one and gave you credit for it being a good second hand. Just as I told you to begin with, its a Rule 74 job and that's the way its going to stand so far as I'm concerned.

Dave knew he had gored Alec pretty deep and felt a little sorry for it, because he knew Alec was honest, as well as obstinate. However, Dave was not satisfied and so he followed up with: "Yes, but Alec, how about that interpretation under Rule 68, page 92?".

"I don't care a snap about that." Alec growled and continued, "and while you are in that line of business, there are some more scrap wheels over there,—if you will snoop around among them maybe you'll find something more of interest to you."

This shot of Alec's registered, as he knew it would, and Dave flared up and came back, "Look here Alec, don't you accuse me of snooping, not a time. It was just by accident that I came by here and caught this job of yours, and to offset that bill of yours, you can just give me a good defect card, 'properly filled in on both sides with ink or black indelible pencil' ". Dave maliciously quoted the last phrase of the rule.

"That would be bright in me, wouldn't it?" said Alec, "giving you a defect card in rebuttal of my own bill. Nothing doing, that's all."

"All right then Alec" said Dave testily, "we've generally been able to settle our differences between ourselves, and I'd rather do it that way, but since you choose to be so hard-boiled, I'll tell you what I'm going to do. I'm going to get Ed Hunt of the G.Y.M. to come over here and sign joint evidence with me on this slid wheel and I guess that will block your bill."

"I don't give a dang what you do", Alec retorted, as he turned and walked away.

Dave went straightway and got Ed Hunt to come over and sign joint evidence with him and mailed it in to the G.F.C.R. at North Yard Shop that evening.

Alec called the second trick inspector up to ask where the car came from. Joe sleepily said he didn't know, that it was standing first out on track number one when he passed that way going to the passenger station to meet No. 26 and the worn flange attracted his attention, he gaged the wheel and applied his bad order ticket and hurried on to the station. Then, later on, while he was down in the other end of the yard, the switchmen had placed the car on the rip track—he noticed it there when he came in at knocking-off time. That was all he knew about it.

Alec had a bad night. He dreamed about slid flat wheels and in his dreams that particular wheel had such

a big flat spot on it that when he rolled it over the flat surface struck the rail and he was unable to budge it again, and it seemed to him that he had spent the remainder of the night tugging at it.

Alec started to work early next morning, because he wanted to go by the yard office and trace the movements of that car and find out where it came from. As he crossed he tracks he met the switch foreman who handled the car and the foreman cleared the whole matter up, voluntarily, as follows:

"Alec, you had a Q.I.C. car on the rip yesterday that I intended to tell you about. Day before yesterday, as I started in from switching the coal yards, the Q.I.C. switch crew came out on the lead ahead of me, they had only this one car for us and Jim asked me if I'd bring it on in and save him the trip down to the interchange, as he had been switching down in Mill Town all morning and was having to run for water. I told him I would, so he dropped it on the lead in front of me—and I kicked it down in number one track with the other northbound stuff. Before I got a chance to see you Skippy came after me with a bunch of green orders and it slipped my mind completely."

"Well, say!" said Alec, stopping short, "it's not possible that you slid a wheel on that car, is it?"

"Sure not," was the answer, "I only moved it a distance of two or three blocks."

Alec hurried by the yard office to verify the movement, then over to see Dave before he went to work. Dave was just starting out and met Alec.

"Hello, Dave", said Alec, "I've just learned that our folks didn't slide that wheel after all."

"Well, somebody slid it," said Dave, "and you took it out."

"Yes", Alec went on, "I supposed it had come in on our road but, instead, the switchmen interchanged it there at the south end of the yard and had only handled it a few car lengths before they put it in the rip track. They got it from your folks through the cross-over."

"Huh!" ejaculated Dave. For a moment he stared at Alec with stubborn incredulity, then, seeming not to have grasped the full meaning of Alec's statement, he added, "Well, what's that got to do with it, anyhow?"

"Just this" said Alec, "I want a good defect card for one pair of slid flat wheels, 'properly filled in on both sides with ink or black, indelible pencil' ", handing back Dave's jibe of the previous afternoon, in quoting the last phrase of the rule.

"Oh! That's it, is it?" Then Dave continued, slowly, "Well, nobody can blame you for wanting. Your mind has, of course, changed since the boot got on the other foot, but the first paragraph of Rule 74 is just the same as it was yesterday, and that's what the job was done under, you know."

"Then, you refuse to card it, do you?" Alec asked.

"Sure I do. Since it was too late for you to give me a card yesterday, its 'way too late for me to give one today, 'Sauce for the goose, sauce for the gander', you know." Dave said this with a degree of finality that convinced Alec that further discussion would be futile, so he said, as he turned to leave:

"Well, Dave, I'm glad you sent that joint evidence in. Maybe it will help some."

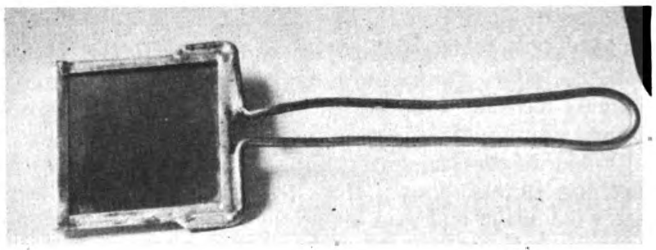
"You go to the devil" Dave snapped over his shoulder as he walked off in the opposite direction.

Alec and Dave are as chummy as ever now, but how in the 'rule book' did this jumble ever get straightened out?

* * *

A Mirror for Car Inspectors

THE general car foreman of an eastern railroad shop designed and made the small hand mirror shown in the illustration for the use of car inspectors, to enable them to inspect parts of car trucks which normally would not be seen. The mirror is enclosed in a light 3-in. by 3¼-in. metal frame and is fitted with



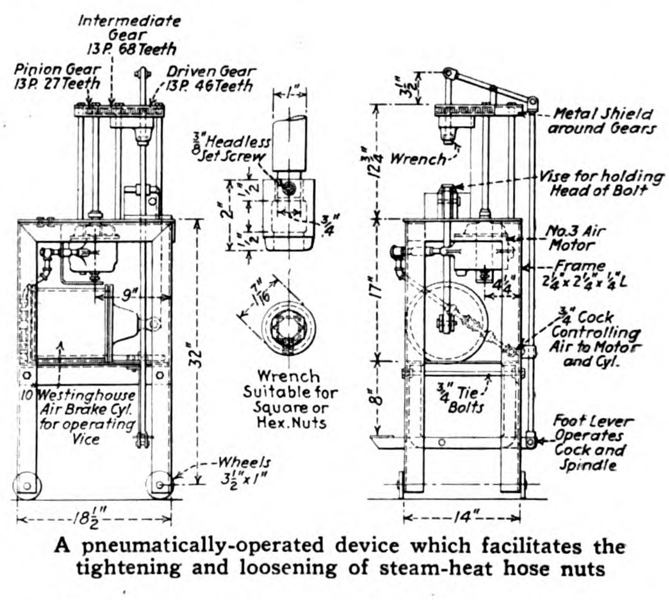
A 3-in. by 3¼-in. hand mirror with a 7-in. pliable handle for car inspectors' use to locate defects normally not seen from the ground

a ⅛-in. copper-wire handle, 7 in. long. The flanges of the case and the pliable copper handle are soldered together to form one integral piece.

During the past year, with the aid of the mirror, one car inspector alone found 24 cracked arch bars which otherwise would not have been discovered without taking down the trucks. In addition, this inspector inspected all the cars in his assigned territory and made a nominal number of yard repairs besides completing other odd jobs.

Removing and Tightening Nuts on Steam Hose

BECAUSE of the pressure to which steam-heat hose is subjected it is desirable to have the nut on the clamp as tight as possible. When this nut has been drawn up tightly and the hose has been in service for a considerable period of time it is often difficult to remove it. With this in mind, the device shown in the drawing was built to facilitate the application and removal of the nut.



A pneumatically-operated device which facilitates the tightening and loosening of steam-heat hose nuts

It consists of pneumatic device for hold the head of the bolt, a wrench which is actuated by a train of gears operated by a No. 3 air motor, and a suitable stand for mounting the various units. This stand is 32 in. high, 14 in. wide and 18½ in. long and is mounted on wheels, 3½ in. in diameter. The frame of the stand is constructed of 2¼-in. by 2¼-in. by ¼-in. angle iron.

The air cylinder for operating the vise which clamps the head of the bolt is mounted beneath the table of the stand and held in position by a bracket supported by ¾-in. tie bolts. The air motor for operating the wrench is also mounted beneath the table. The spindle of the motor is extended above the table to the gears which actuate the wrench.

The wrench is so designed that it can be used on either square or hexagon nuts. It is connected to a foot-lever arrangement which moves it up and down, the shaft to which the wrench is bolted being designed so that it can slide in the gear which actuates it. The foot lever also operates the air valve which controls the motor.

When in use, the head of the bolt is placed in the pneumatic vise and the foot lever is lowered. As it moves downward, it pushes up the long lever at the back of the stand, opening the air valve and starting the motor. The upward movement of this lever moves the now rotating wrench downward on the nut, tightening it. The air motor can be reversed by hand when it is necessary to use the device for loosening the nuts.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Defect Card Claimed Improperly Issued

On June 3, 1928, Marion steam shovel No. 3517, traveling on its own wheels with boom loaded in Erie car 8703, was delivered along with eleven other cars by the New York, Chicago & St. Louis to the Terminal Railroad Association of St. Louis. Inspection was made at the receiving connection by T. R. R. A. of St. L. inspectors and the coupler-casting carry bolts on the A end of the car were found to be in a bad order.

The car was moved to the T. R. R. A. of St. L. repair track and a claim was made against the N. Y. C. & St. L. through the chief interchange inspector for the following additional defects: one metal end sill bent; one end-sill angle bent; two metal draft-sill flanges bent; one end-sill brace bent; one coupler casting bent and broken; one ash-pit bottom sheet bent; two ash-pit side sheets bent; two ash-pit angles bent.

On June 7, 1928, the chief interchange inspector issued a defect card in favor of the T. R. R. A. of St. L. and against the N. Y. C. & St. L. for the above defects. Repairs were made by the former road and a bill rendered against the Nickel Plate.

At the time of the original inspection on June 3, the delivering line's general forman notified the T. R. R. A. of St. L. foreman that he would look up the interchange records on the car and if the Nickel Plate was responsible that the chief interchange inspector would issue defect cards against the Nickel Plate covering the damage. On June 7, the chief interchange inspector asked the Nickel Plate foreman what he was going to do about the steam shovel as the T. R. R. A. of St. L. wanted to know what disposition to make of it and stated that, if the Nickel Plate did not give the Terminal railroad a defect card, that road was going to send the shovel back.

The Nickel Plate foreman informed the chief interchange inspector that the inspection record did not cover all the defects found when the car was moved to the repair track. The chief interchange inspector stated that in his opinion all the damage had been done at the same time. In order to get the shovel repaired and moving without further delay, the Nickel Plate foreman advised the chief interchange inspector that if he thought that the N. Y. C. & St. L. was responsible that he could give the T. R. R. A. of St. L. a defect card and have them do the work. A defect card was issued, the repairs made and a bill rendered, which was paid.

Ten months later the Nickel Plate submitted the case to the Superintendents' Association of the St. Louis-East St. Louis Terminal District, contending that, if either the coupler casting or casting bolts were defective at the time the equipment was delivered to the T. R. R. A. of St. L., the defects should be considered as owner's defects and that the additional damage occurred when the T. R. R. A. of St. L. handled the shovel a distance of two and one-half miles to its repair tracks. It also contended that the chief interchange inspector should have handled the case on the basis of the interchange the record—inasmuch as he disregarded A. R. A. Rules 2 and 4, in that defect cards are not issued at the time cars are interchanged—and that he should not have requested the Nickel Plate foreman to give his authority to issue a defect card against the N. Y. C. & St. L. to prevent further delay and daamge to the equipment.

The T. R. R. A of St. L. stated that, owing to the damaged draft rigging at the north end of the steam shovel at the time of the delivery by the Nickel Plate, the shovel broke off from the next car north in the cut being switched over the hump and run south down the hump. There was no damage done to the south end of the shovel and a subsequent examination showed that the train had parted because of the bad order condition of the coupler casting.

The T. R. R. A. of St. L. contended that the Nickel Plate was responsible for the damage to the steam shovel, pointing out the fact that the case had been submitted to the Superintendents' Association of the St. Louis-East St. Louis Terminal District and that the issuance of the defect card against the Nickel Plate was sustained by that organization.

The decision as rendered by the Arbitration committee follows: "The contention of the Terminal Railroad Association of St. Louis is sustained on the basis of the next to the last paragraph of Rule 4."—*Case No. 1655—Terminal Railroad Association of St. Louis vs. New York Central & St. Louis.*

FIFTY YEARS AGO.—The locomotives recently built for the use of the Bound Brook line of the Reading are the heaviest ever built in this country for fast pasenger service. These are of the American type and have a total weight of 96,200 lb. with a weight per driving wheel of more than 16,000 lb. The locomotives are equipped with the Wooten type boiler for burning anthracite coal.—Railroad Gazette, January 14, 1881.

Dirty and Inoperative—Why?

By An Old-Time Air Jammer

This article was contributed by a general air-brake foreman who has signed himself "An Old-Time Air Jammer." He objects to the frequent use of the phrase "dirty and inoperative" on car-repair bills. There are phrases of similar nature, for instance "waste grab," that do not mean much and are of no assistance in really correcting defects. Further discussion, designed to abolish the use of such phrases, is invited

"DIRTY and Inoperative." What a multitude of sins those three words cover!

When we consider the advancement and improvements made in the air brake in the past 15 years, why do some continue to use that old phrase, "Dirty and inoperative?" Have the rip-track inspectors and write-up men, who write and check the bills for cars while on the repair tracks, fallen by the wayside?

When we have a car on the repair tracks, where we find that the brakes are not working properly regardless of the cause, why do they still persist in using these three words, "dirty and inoperative?" When we have a car where it is necessary to clean the brake before the 60-day limit or even the nine-month limit has expired are there no other defects found but "dirty and inoperative?"

To illustrate, we have a foreign car on our repair tracks where we find the brake is subject to cleaning. We clean the cylinder, change the triple valve, clean the dirt collector and retaining valve, test the brake-cylinder leakage with a gage screwed in the triple valve, keep the leakage down to 5 lb. per min. or less, test the retaining valve, charge the brake and test it with the single-car testing device, soap-suds all connections, tighten all connections, and know that the brake is OK in every respect.

This car will run perhaps 30 or 40 days, will be knocked around by switch engines and in trains, and perhaps be put in on some rip track for coupler or other defects. The air men come along and test the brake and condemn it on the slow-application or release test. They will notify the inspector or write-up man that the brake will not pass the test on account of not applying.

Then what happens? The bill is made for C. O. T. & S. as per Rule 60, and then is sent to the car owner who sees that the 60-day limit has not expired. He sends the bill on to the road which cleaned the brake shortly before, asking that road to cancel it.

The bill will be received by the accounting department which will send it to the superintendent of motive power and he in turn sends it to the master car builder, who turns it over to the general car foreman, and from him on to the air-brake foreman with a note pinned on it "Why?", and the first thing that is noticed is "dirty and inoperative."

Several years ago a certain road put a series of cars through the shops where steel ends were applied and the cars rebuilt. All the cylinders and reservoirs were taken down and new packing cups and cylinder gaskets applied. These cars were equipped with H1 triple valves, which were removed and new K2 triples were put on after being put over the 3-T test track. New pipe was applied to all the cars and, when completed, they were tested by an experienced man with the new single-car testing device.

This work was watched by two car foremen and the general car foreman, and was checked by the air-brake foreman. Shortly after the cars were put in service three bills were received from foreign roads, and in each and every case the bill showed in the "why made" column "dirty and inoperative."

Are all the defects "dirty and inoperative?"

Doesn't anything ever happen to a brake?

Doesn't the brake ever leak off?

Doesn't the triple ever blow the retaining valve?

Doesn't the brake ever go into emergency when making the service-stability test?

Doesn't the brake ever fail to release in position No. 2 on the testing device?

All these defects go to make up a bill. Why not, when making out the repair bill at the car, state the true cause and not that old worn-out excuse, "dirty and inoperative."

The A. R. A., the Air Brake Association, the manufacturers' experts, the air-brake supervisors, the air-brake foremen and the rank and file in general, all are working and doing their best to put the air brakes in 100 per cent condition. The days of piecework and the old-time method sometimes used of cleaning the brake with a stencil brush are things of the past.

With the coming of the 3-T test rack we reduced the packing-ring leakage from 5 lb. in 30 sec. to 5 lb. in 1 min., and some are holding it below that.

The leakage indicator came along and showed us that our slide and graduating valves were not as good as we thought they were. The friction indicator helped a lot too. The composition-packing cup and rubber cylinder gaskets were a blessing. The use of gages showed us where the parts were below the limits. The step-cut ring, in four sizes, with the gages available to measure the bushing for a proper packing ring, were a godsend. Improved bushing grinders make the bushing true for this ring. The diaphragm cock on the test racks did away with the old key cock—one could never tell when it was leaking. The improved single-car testing device was given to us, it has done its duty and has well paid for itself.

Train-line leakage has been brought down to nothing. No more do you hear a compressor groaning on account of the strain put on it to keep up the pressure caused by leaks in the train line. We are gradually getting away from steel pipe and are using wrought iron. We are gaging the cylinders on every car that comes on the rip track to see that the brake complies with the A. R. A. rules. We are applying the brake through a .035-in. orifice to

ascertain how the brake will work on the rear end of a 100-car train. We release the brake through a .0225-in. orifice to determine how it will release. The men in the air room have been educated to know that a triple valve is something besides a chunk of iron with a lot of dodads in it. Our test-rack men know what is required of them and are not letting anything slip by.

Our air-brake supervisors are checking the work on all tracks and the A. R. A. checkers are on the job too. The I. C. C. is checking up on all of us—and try to slip anything over on them and get by with it! Look at the air-brake that we have today and compare it with what we had 40 years ago.

Think of the time, study and money it has taken to put this where it is today and then stop and think that we are still getting bills sent back to us with the notation "dirty and inoperative" when it was really a cylinder gasket that was blown out.

Come on, you rip-track men who write these bills; let us know what is really wrong. If a brake is inoperative, ask what the trouble is.

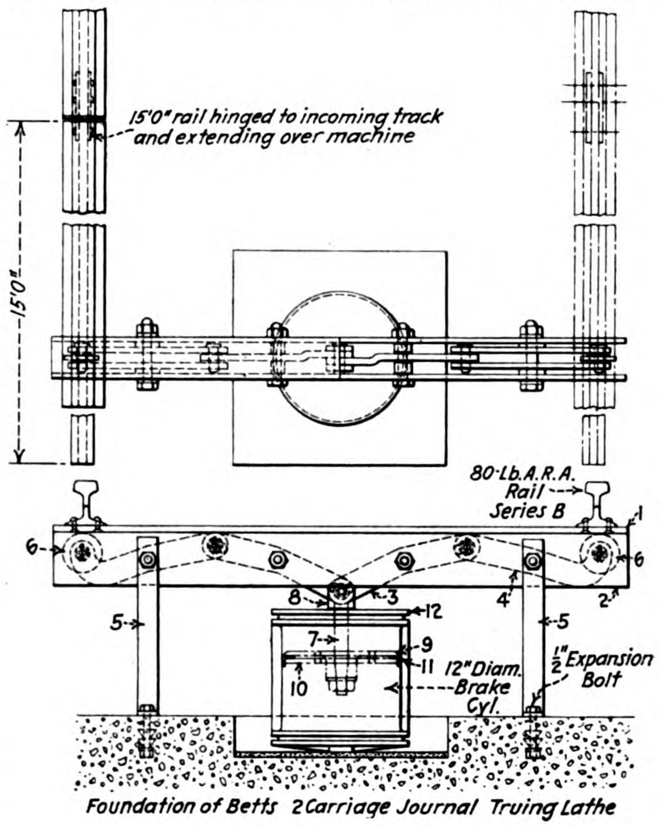
We know that curiosity killed the cat, but no one ever got killed for asking questions. If the air man condemns a brake, find out what is wrong. He will tell you and then on your bill show the real facts; you may be doing some one a great favor. But for the love of Mike find some other excuse than "dirty and inoperative."

Wheel Raising Device for Betts Journal-Truing Lathe

THE wheel-raising device, shown in the two drawings, is used in a railroad wheel shop to raise mounted wheels for rolling into position on a Betts two-carriage journal-truing lathe. As shown in the assembly drawing, the rails of the inbound track are hinged 15 ft. from the rear of the bed of the machine. The rails extend through the filler-block gaps of the machine.

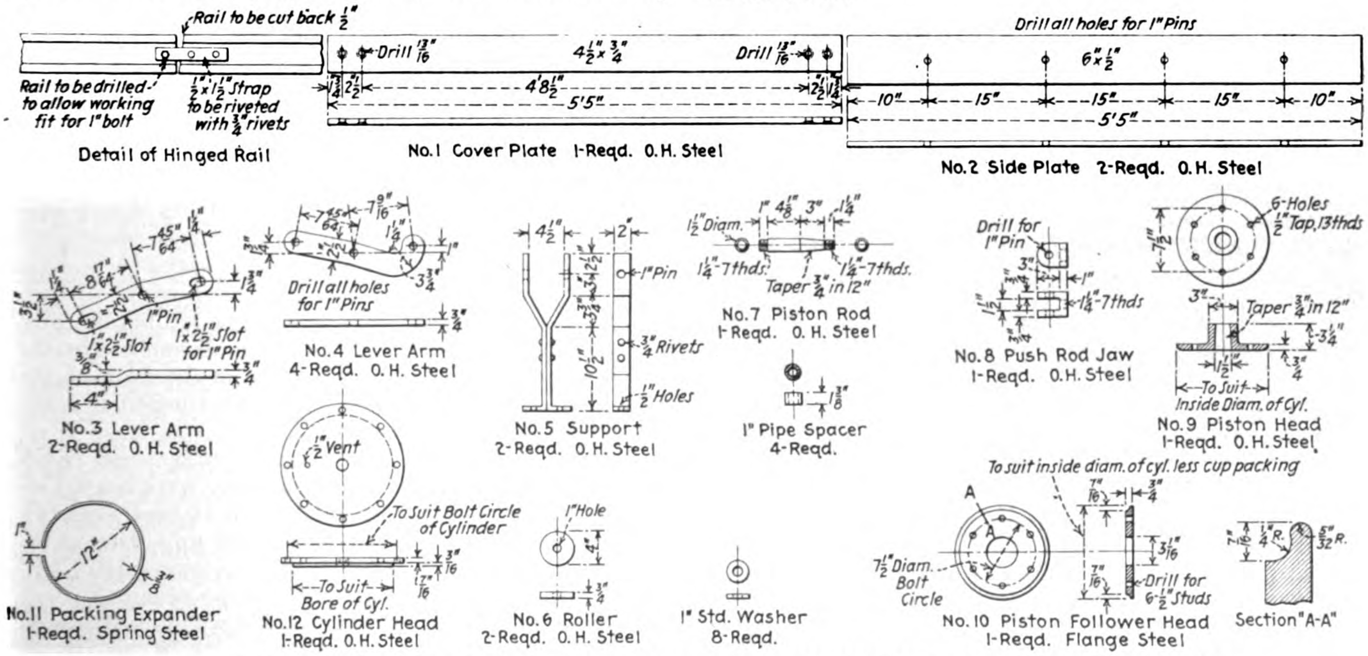
The wheels are rolled up the inclined track into position between the spindles. They are raised to the desired height by means of air pressure in the 12-in. brake cylinder, which raises the track and wheels through a system of levers. It will be noted from the assembly drawing that the upward movement of the track is brought about by upward movement of the brake-cylinder piston. The track is depressed by releasing the air in the cylinder which is exhausted by the weight of the wheels and track.

Only a short movement of the piston is required to locate the axle centers. Adjustment of the axle centers to the spindles can be made quickly and with little effort



Wheel-raising device for a Betts two-carriage journal-truing lathe

on the part of the machine operator; vertical movement of the wheels is obtained by operating the compressed-air valve and horizontal movement by rolling the wheels on the track.



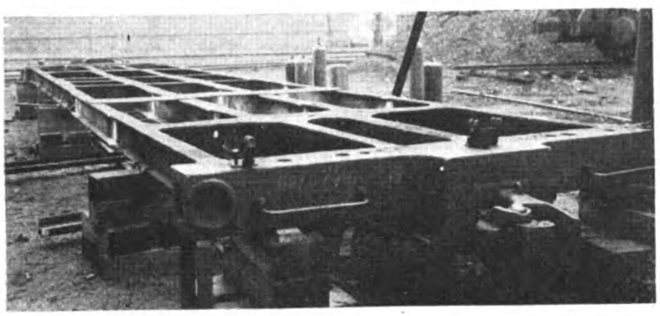
Details of the wheel-raising device—The numbers refer to those shown on the assembly drawing

In the
Back Shop and Enginehouse

Tender Underframes* Lengthened by Welding

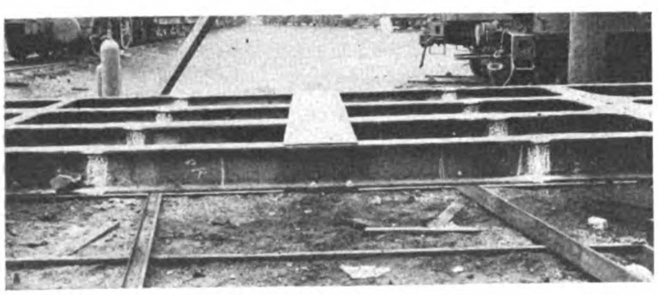
By E. V. David †

TO obtain tenders of increased capacity, demanded by the adoption of locomotives to longer runs and heavier trains, the Nickel Plate recently lengthened nine tender underframes and the tender tanks. It was desired to place the locomotives to which these tenders belonged on non-stop freight hauls between Conneaut, Ohio, and Buffalo, New York, and also between Conneaut and Bellevue, Ohio. The coal capacity of the tenders was already ample for the longer runs, but it was necessary to increase the water capacity. Estimates showed that the tanks would have to be lengthened by 8 ft.



One of the tender underframes after being lengthened by welding in four I-beam sections

Accordingly, the tanks were removed from tenders and cut in two with the oxy-acetylene torch at a predetermined point. The two sections were then separated 8 ft. apart and trammed in alinement. Plates 8 ft. in width with suitable stiffeners were inserted in the gap and riveted and electrically welded in place, thus completing this part of the job.



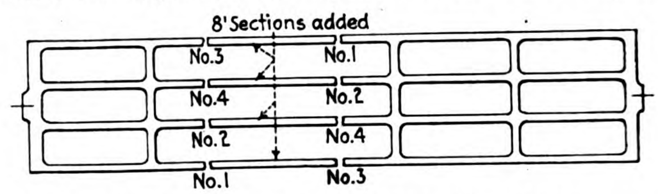
A close-up of the sections added to the underframe and the tie-plate riveted across the centers of the inserted sections

The one-piece cast-steel tender underframes were removed from the tender trucks and likewise cut in two with the oxy-acetylene torch at a suitable location. This entailed cutting of four longitudinal members of each underframe, each of I-beam cross section. Next, the two sections of underframes were separated 8 ft., blocked up about 3 ft. above the ground, trammed and brought into correct alinement with each other.

Cast-steel I-beams 8 ft. long, 12 in. deep and with the same cross section as underframe members, were placed in the gaps, held in place by clamps and oxy-acetylene welded at both ends to the tender underframe.

The appearance of an under-frame, after the welding was completed, is shown in one of the illustrations. The 8-ft. section inserted in each of the four longitudinal members, required a total of 8 welds per underframe. A close-up of sections added to the underframe is also illustrated. The points at which welds were made have been chalked to make them stand out more clearly. To further strengthen the underframe, tie-plates were riveted across the centers of the inserted sections.

In the welding procedure followed, due allowance was made for expansion and contraction in order to preserve the proper alinement of the underframe.



The location of the I-beam sections added and the sequence of the welds made

The drawing show the order in which the welds were made. Four welders were actually working at the same time. After clamping the 8-ft. sections in place, two welders started work at each point designated as No. 1, and completed these two welds first. Next, the welds at each of the points marked No. 2 were completed by two welders.

Up to this juncture no tie-in welds had been made. The first tie-in welds which joined the two sections of the underframe together were the two designated as No. 3, which were completed next, each by two welders.

After finishing the two No. 3 welds, it was found that the frame had contracted together so closely at the two No. 4 points that it was necessary to build a charcoal fire around each No. 3 weld in order to give the expansion required at the No. 4 points before proceeding with these welds. Sheet asbestos and fire bricks were used to protect the welders from the heat of the fires. The two No. 4 welds were then completed without difficulty.

On the following day, charcoal fires were built around each of the eight welds and they were heated simultaneously to a cherry red to relieve and equalize any strains which might have been set up. The welding time per underframe per welder averaged 10½ hr., a total of 42 hr. for the four men being required.

Material used per underframe for welding averaged approximately 1,780 cu. ft. of oxygen, 1,780 cu. ft. of acetylene and 90 lb. of vanadium steel welding rod. In

* Paper presented before the New York Section of the American Welding Society on February 24, 1931.

† Air Reduction Sales Company, Applied Engineering Department.

addition, an average of approximately 100 lb. of charcoal was required per underframe for heating the two No. 3 sections while welding at the two No. 4 points, and 200 lb. of charcoal for heating up all welds to a cherry red on the following day, to relieve and equalize strains. Firebrick and sheet asbestos were employed as required.

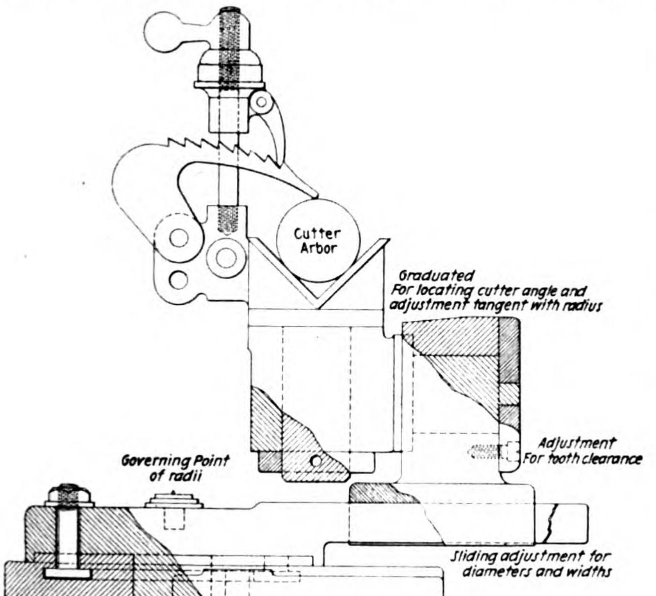
Assuming average unit costs, the following table gives an estimate of the total oxyacetylene welding cost per tender underframe.

Labor:		
42 hr. welding time @ $.80 per hr.		$33.60
Material:		
1,780 cu. ft. oxygen @ $1.25 per C	$22.25	
1,780 cu. ft. acetylene @ $2.50 per C	44.50	
90 lb. vanadium-steel rod @ $.22 per lb.	19.80	
100 lb. charcoal (while welding) @ $.02 per lb.	2.00	
200 lb. charcoal (heat-treating) @ $.02 per lb.	4.00	
Firebrick, asbestos paper, etc. (estimated)	1.00	
Total material, per underframe		93.55
Total labor and material, per underframe		$127.15

Fixture for Grinding Cutters and Reamers

*By Frank R. Esser**

SHOWN in the illustration is a fixture for sharpening channeling cutters and radius reamers on a universal guide without removing the blades. This fixture can be used to advantage especially in shops not equipped with special-purpose grinders for sharpening large channeling cutters. It can be used on a universal or plain cutter and reamer grinder and will answer the purpose in every particular. Anyone confronted with this problem appreciates the difficulties encountered in grinding the radii on the inserted blades so that they will not only maintain proper clearance, but will blend with the peripheral and side-cutting faces.



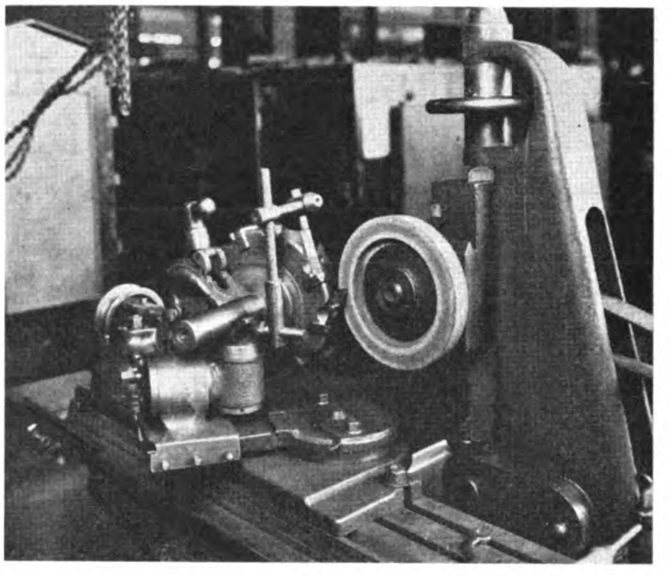
Fixture for sharpening channeling cutters and radius reamers on a universal grinder without removing the blades

This fixture was designed and built at the Delaware & Hudson shops at Colonie, N. Y., and will not only take care of the radius, but will also sharpen the sides of the blades. Periphery grinding is handled in the usual manner as when sharpening plain cutters.

The rotating base has for its pivoting point three discs in step sizes, each one of which is the true radius of the inserted cutter blades to be ground. For every variation in radius a corresponding disc must be provided or proper allowance made from the dead center.

In setting up for grinding, the table is adjusted so that the edge of the disc (for inserted cutter blades of identical radius) is in direct vertical alinement with the side or cup face of the grinding wheel. The table is then locked in position. The cutter, mounted on a mandrel, is then placed in the holding fixture with the extreme radius of the blade touching the wheel at a point plumb with the edge of the disc. This automatically sets the proper radius for grinding. An adjustable tooth rest insures uniformity.

The radii on opposed inserted cutter blades are



Application of the fixture showing the rotating base

ground in the same manner as described by reversing the cutter arbor and adjusting the Vee-type holder 90 deg., which brings the opposite side of the cutter tangent with the opposite side face of the grinding wheel.

Staggered-tooth milling cutters 12 in. in diameter can be ground. Radii as small as 1/8 in. are accommodated.

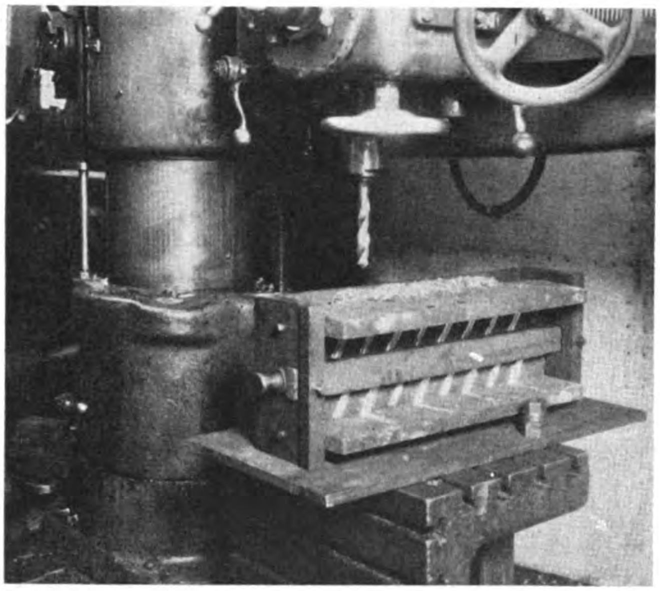
The following tools can be accurately ground with this fixture: Milling cutters, spherical-joint reamers up to 6 in. radius; by-pass valve reamers; superheater-unit joint reamers; crank-pin counterbores, and ball-bearing forming tools.

*Mr. Esser is shop engineer at the Colonie, N. Y., shops of the Delaware & Hudson.

Crosshead and Piston Drilling Jigs

MOST of the wear on the top crosshead shoes of locomotives equipped with the alligator-type crosshead is lateral, and, in order to secure maximum service life from the Hunt-Spiller shoes used on a great majority of large locomotives of the Chicago, Rock Island & Pacific, this road machines the top guide 1/4 in. narrower than the bottom guide. This permits transferring the top shoe to the bottom as soon as a lateral play of 1/4 in. develops and obtaining a second period of effective service from each shoe.

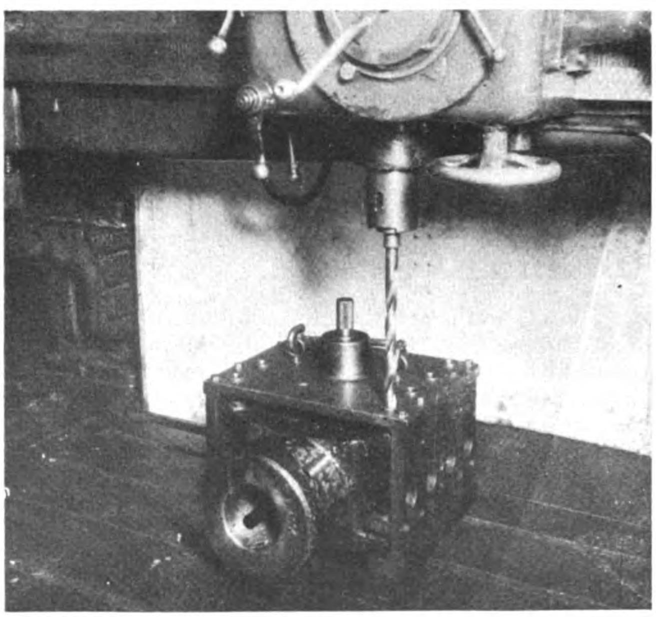
The practicability of thus interchanging top and bottom crosshead shoes depends upon a standardized size and location of bolt holes. This is secured by the use of special jigs at the Silvis (Ill.) shops of the Rock



Jig used in drilling crosshead-shoe bolt holes at Silvis shops of the Rock Island

Island, as illustrated, six sets of these jigs being sufficient to cover most of the classes of heavy power on that road.

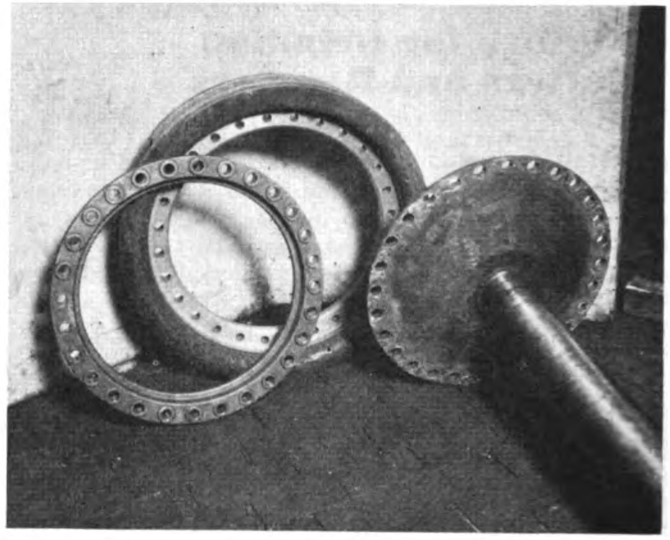
For drilling crosshead shoes, the jig consists of a substantial steel plate with the ends bent at right angles and spaced to receive the shoe with very little clearance, or end play, which can be taken up by two set screws, as shown. The ends are slotted to accommodate a narrow steel bar which holds the shoe firmly against the back of the jig by tightening two additional set screws. The back plate of the jig has two steel ribs, corresponding to the cheeks of the crosshead, which fit over the part of the shoe where holes are to be drilled and accurately positions the four 1-in. holes by means of hardened steel bushings, properly located. The ends of the shoe jig are equipped with centrally-located pins for use with a lifting hook in conveniently handling the jig from the floor to the drill table, or revolving the jig and shoe to any position desired on the drill table. Obviously, the use of this jig assures the standard size and location of bolt holes in crosshead shoes, at the same time saving the labor and expense of laying out holes which would otherwise be required.



Crosshead drill jig which assures standard location of bolt holes

Crosshead Drill Jig

To secure a standard location of bolt holes in the crosshead, also, the crosshead jig, shown in the second illustration, is used at Silvis shops. It is of built-up steel construction, comprising primarily a housing to receive the crosshead, with eight hardened-steel bushings accurately positioned in the top plate, and four bushings in each of two ribs, or projecting plates, on the inside. The crosshead is properly located in the jig by means of a round plug, the upper knurled end of which is shown, extending through a hardened and ground bushing applied to the wrist-pin hole. The slightly elliptical hole in the crosshead jig, proper, permits a small amount of lateral motion of the crosshead, but accurately positions it longitudinally to give the correct location of crosshead shoe holes. The crosshead is held firmly in position by clamp bolts and the holes drilled in both cheeks of the crosshead at one setting.



Ring drill jig used for drilling piston centers and bull rings

This jig is, of course, used in the drilling of new crossheads. In case the crosshead bolt holes are worn in excess of 1¼ in., they are plugged by electric welding with soft steel wire, and re-drilled, using the same jig. After the shoes are assembled in the crosshead, the holes are reamed, using a taper of $\frac{1}{16}$ in. per ft. and bolts fitted in an engine lathe.

Not only does this drilling arrangement permit getting a double service life from the Hunt-Spiller crosshead shoes, but the interchangeability permits sending shoes to outlying terminals with the assurance that they can be used on locomotives of a specified class and thus, in some instances, avoids locomotive delays.

Drill Jig for Piston Bull Rings

The cast-steel centers of locomotive pistons seldom break, but the cast iron bull rings are subject to more or less rapid wear and have to be renewed, which involves drilling them, in some instances, for as many as 28 rivets. The necessity of having holes in the bull ring drilled with considerable accuracy is apparent, and one means of doing this is to use the piston bull ring as a templet during the laying out or drilling operation. In case the piston rod is still in the piston center, how-

ever, this is an awkward operation, and a much more quick, accurate and generally satisfactory method is to use the comparatively light ring drill jig, illustrated. This is made of steel with hardened-steel bushings pressed in and located so as to provide for the proper number of rivet holes properly located.

The ring drill jig has, on one side, a recess corresponding to the shoulder on the piston center and, on the other side, a shoulder which just fits into the smallest diameter of the bull ring. The ring can thus be used with one face against the piston center, or the other against the bull ring, while holes are being drilled, with every assurance that the holes will line up exactly when the piston center and bull ring are assembled for riveting.

Sandblasting

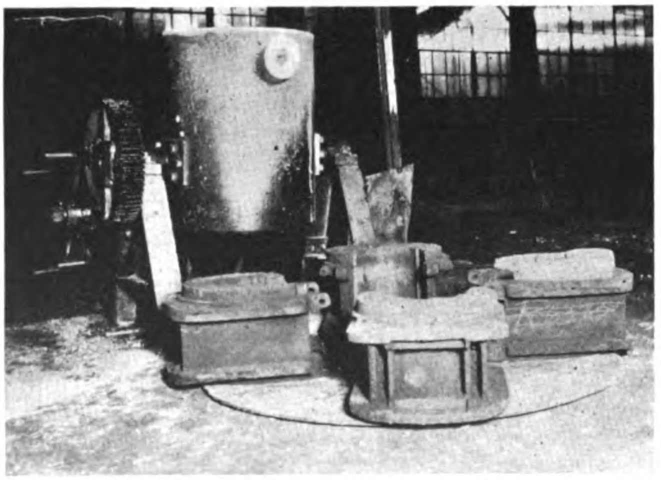
EFFECTIVE use of a sandblast shed and equipment is being made at the locomotive shops of the Chicago, Burlington & Quincy at West Burlington, Iowa. This shed, illustrated, is approximately 30 ft. wide by 80 ft. long, being constructed of sheet iron on a timber frame. Shop air pressure is piped to the shed through a three-inch line which makes approximately 90 lb. pressure available. In one corner of the shed is a storage bin for the white silica sand shipped to the shop in carload lots and used for sandblasting. While a sand drier is installed in the shed and was at one time used, this practice has been discontinued as unnecessary with sand of average moisture, and, consequently, sand from the storage bin is simply shoveled to a vibrator which eliminates any foreign material or excessively large pieces. From the bottom of the vibrator, sand is delivered through a 2-in. pipe by air pressure to the top of a sandblast container or drum, 36 in. in diameter by 50 in. high. By means of a gate valve, the sand in the top of the container can then be passed by gravity to the mixing chamber or tank underneath. The gate valve is closed, and air pressure applied, sand feeding by gravity and air pressure to the syphon underneath the mixing tank, where it mixes with the stream of air at shop air-line pressure and is conducted through a 1½-in. rubber hose to the nozzle pipe and the parts to be sandblasted. Two nozzle pipes, which can be used simultaneously from this machine, are ½ in. in diameter. A service life of approximately three months is secured from the hose, but the pipe nozzles cut out usually in a few hours. The sandblast operator has an assistant who works the sand and dust over on the floor and gradually gets that sand which is suitable for re-use back toward the vibrator.

Sand blast shed and loaded push cars at the West Burlington (Iowa) shops of the C. B. & Q.

Approximately thirty locomotives a month are normally handled at West Burlington shops, and a large part of the locomotive equipment, including frames, cylinders, boilers and accessories, is sandblasted. Stripped locomotives, mounted on their front and back trucks, are moved into the sand house, except on quiet, fair days when the work may be done out of doors. Locomotive tenders and tanks are sandblasted preparatory to repainting. Small parts are loaded on push cars for movement between the shop and the sandblast shed. The boilers are sandblasted inside and out, which has the effect of thoroughly removing dirt and scale and permitting the detection of any flaws in the steel, such as cracks, and plates with an undue amount of pitting or corrosion. Air pumps are sandblasted, also the exteriors of airdrums, jackets, etc. Pistons and crossheads, after going to the lye vat for the removal of most of the grease, are sent to the sandblast shed and sandblasted. While sandblasting the interior of a boiler, a motor-driven fan is used to get rid of the sand in the atmosphere and, in fact, this is the only means by which the operation can be carried on. By starting at the front end and adjusting the fan to blow the sand-filled air toward the firebox end, reasonably satisfactory working conditions can be assured.

Turntable for Pouring Hub Liners

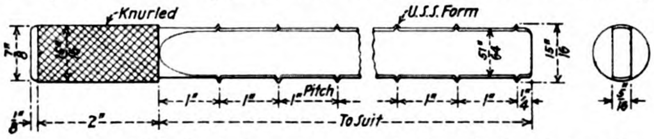
IN the illustration is shown a trunion-mounted brass-melting furnace in front of which is set a table, capable of supporting eight of the largest sized driving boxes each of which may be rotated in turn before the spout of furnace during hub-liner pouring operations. The turntable is 7 ft. in diameter and is mounted on a roller- and ball-bearing stud, pressed into the bored center of a scrap 26-in. cylinder head. The cylinder head, which forms the base of the turntable, is anchored in concrete with 1⅛-in. bolts. The turntable is constructed of a thin cast-iron plate set on a discarded bull gear, 6 ft. in diameter, which in turn is mounted on the ball-bearing stud fitted in the cylinder head.



A turntable set before a brass-melting furnace which rotates driving boxes before the spout of the crucible

Gage for Testing Pitch of Threads

A SIMPLE but effective gage for checking the pitch of threads on staybolts, taps, etc., is shown in the drawing. The gage is made to suit any specific application desired, the pitch of the threads being the distance between each of a series of raised thread-like points on the gage. These are raised to a height which is equal to the depth of the threads on the bolt or tap



A gage which is designed to check the pitch of threads on staybolts, taps, etc.

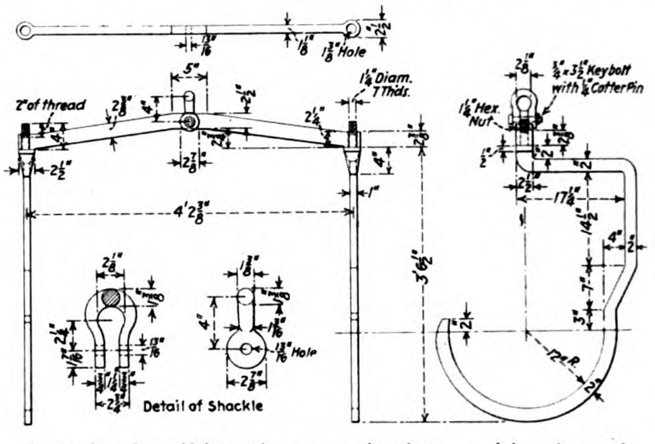
for which the gage is designed. The points are 5/16 in. long and are located on opposite sides of the gage for convenience when the gage is in use.

The length of the gage is made to suit any particular application for which the gage may be designed. It has a knurled handle, 2 in. long and 15/16 in. in diameter. When in use the gage is laid along the threads of the bolts or tap, as the case may be, and the raised pitch points will all fall in its respective thread if the pitch is correct.

Device for Lifting Air Reservoirs

IN enginehouses and back shops diverse means are employed for lifting air reservoirs into position beneath running boards. A device which is designed to expedite this operation is shown in the drawing.

The device is made with two J-type hangers bolted to a cross member, in the center of which is attached an inverted-U shackle for the insertion of a crane hook. The J-type hangers are constructed of 1-in. by 2-in. steel, that portion of the hanger for supporting the reservoir being bent to a 12-in. radius. The two hangers are spaced at a distance of 4 ft. 2⅜ in. by a cross beam made from 2⅜-in. by 1⅛-in. steel with an eye forged at each end. The top of the J-type hangers are bent as shown in the drawing and threaded to permit bolting them to the cross member. They are designed to permit the equalization of the suspended load and with a



A device for lifting air reservoirs into position beneath running boards

4-in. offset in the vertical stem of the J for running board clearance.

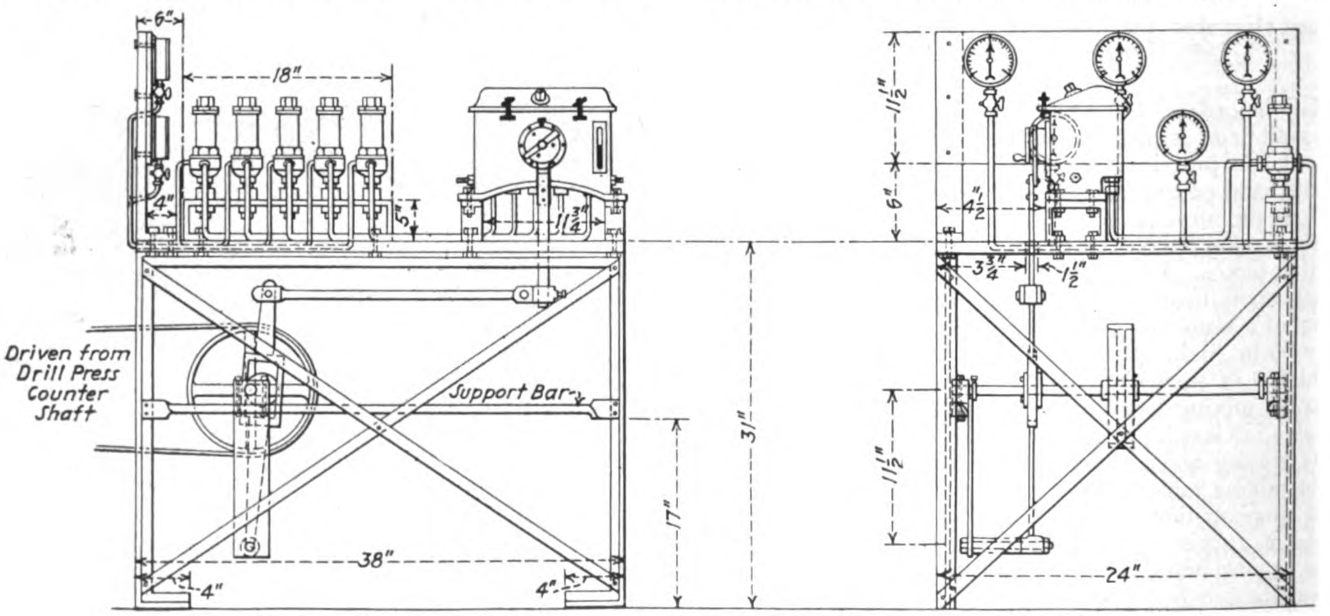
Although the lifting device was primarily designed for raising air reservoirs into position on locomotives in the round houses, where the running board is seldom removed, it can be used in back shops in place of chains, thus removing a safety hazard.

Test Rack for Nathan Mechanical Lubricators

By E. G. Jones

THERE are a number of mechanical-lubricator test racks in various shops, but most of them are quite expensive to build and are not simple. The one used at the Tampa, Fla., shops of the Atlantic Coast Line is simple in construction and economical with respect to the cost of building.

This test rack, shown in the two drawings, is used

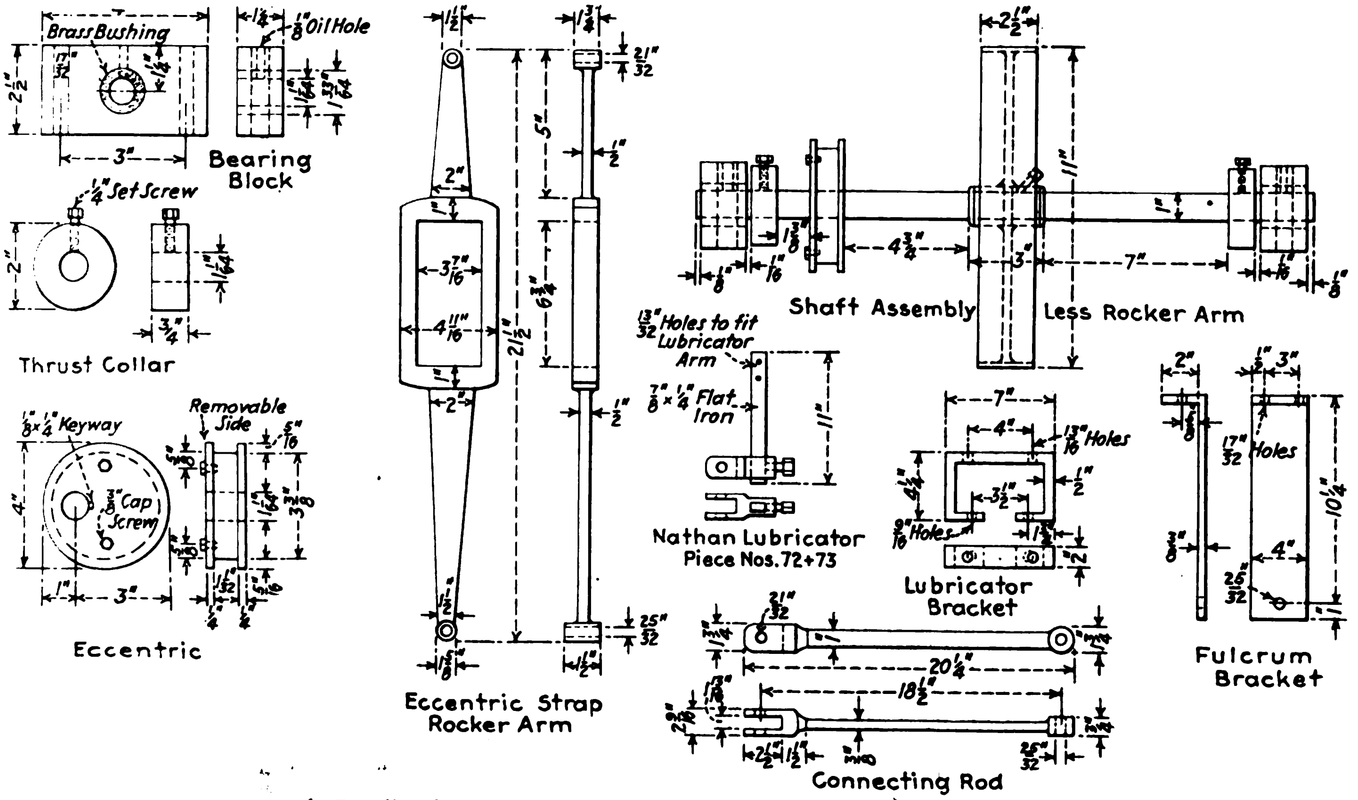


Rack used at the Tampa shops of the Atlantic Coast Line for testing mechanical lubricators

for testing Nathan mechanical lubricators where five feeds are used on the locomotive. However, by the addition of terminal checks, gages and piping more feeds may be tested. This rack can also be used for testing other mechanical lubricators by re-arranging the delivery pipes to the terminal checks.

The test rack is placed near a drill press and its drive motion is obtained from the countershaft of the machine. In our case, the shop is electrified and each machine has its individual motor and, where there was no overhead countershaft or motor available, the drill-press countershaft was used. This gives us various length of time has lapsed, the pressure is again noted and, if found to have decreased, it shows that the delivery-ball check of the lubricator is leaking, provided that the terminal check is not leaking, which, if defective, shows up by an occasional drop of oil at the delivery feed.

After the test is completed, weak pump units are replaced and defective delivery checks are repaired. As already stated, the lubricator can be adjusted and the feeds regulated before it is applied to the locomotive. With this scheme of testing, the results of the adjustments can be observed and guesswork eliminated.



Details of the rack for testing Nathan mechanical lubricators

working speeds by changing from one cone to another.

The driving mechanism of the test rack is simple and close measurements are not absolutely necessary. The eccentric and eccentric-strap rocker arm are preferable to a crank arm. Any desired valve travel, of which there is a variety owing to the design of the eccentric throw, may be used on the test rack. The rack is not bolted to the floor, for it must be lined up when the driving cones are changed. When not in use, it may be moved away from the press.

After a lubricator is placed on the rack and properly bolted down and connected to the pipes, the oil-delivery pipes are filled by cranking the lubricator by hand with the feed-adjusting screws wide open, thus speeding up the operation. When the delivery oil shows up at the bottom of the terminal check, the drill-press countershaft is put in motion and the pulsation of the gage hand noted. This indicates strong and weak pump units in the lubricator. The adjusting screws are then set to the average working speed of the locomotive and checked by noting the number of drops of oil per minute through the delivery end of the terminal check. The delivery oil is caught in a small drip pan placed under the terminal checks.

When the setting of the lubricator pump units is completed, the driving motion is stopped and the oil pressure on the gages noted. After an appreciable

The oil used in testing lubricators on the test rack is a heavy gas-engine oil, the viscosity of which is practically that of valve oil when heated by means of the heater pipe in the lubricator.

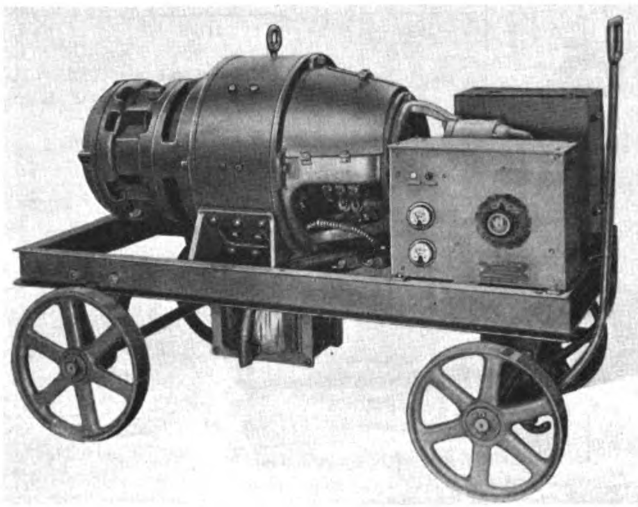
The frame of the rack is made of 1½-in. by 1½-in. by ¼-in. Tee-iron. It can be made of 2-in. by 2-in. by ¼-in angle iron. The cross braces of the frame are made of 1¼-in. by ¼-in. flat iron, and the bearing support bar of 2-in. by ½-in. flat iron. The terminal-check bracket is of 2-in. by ½-in. flat iron, and the gage bracket stand is made of 2-in. by ⅜-in. flat iron. The gage bracket back cover is made of $\frac{3}{16}$-in. sheet iron. The top of the rack is covered with $\frac{3}{16}$-in. sheet iron which is welded to the frame. The three gages are Crosby 5-in., 500-lb. double spring. Nathan Type D terminal checks are used.

Fifty Years Ago.—It is but a few years since 20,000 lb. was considered the maximum load for a freight car, but the figures of the western weighing association show a remarkable increase in this respect. During six weeks nearly 50,000 cars were weighed, and while the average of the different classes of freight ran from 23,750 lb., for machinery, to 29,925 lb., for ore, the maximum in nearly all cases exceeded 30,000, and for some classes of freight reached, respectively, as high as 39,600, and even, in the case of ore, to the enormous weight of 48,500 lb.—*Railway Age*, October 28, 1880.

NEW DEVICES

Westinghouse Flex-Arc Welders

THE Westinghouse Electric & Manufacturing Company recently brought out a series of single-operator welding sets incorporating a feature known as the Flexactor, which is designed to produce a steady, uniform and flexible arc at all current values. The Flexactor is a special form of reactance and its principle of operation is to lessen the time of voltage recovery and to eliminate current surges at the striking of the arc, thus preventing sticking of the electrode. By eliminating current surges, the Flexactor is designed to prevent arc



The 300-amp. Westinghouse Flex-Arc welding set

explosions and overshooting of the ultimate current value during momentary short circuits due to passage of metal through the arc.

The single-operator sets have a common frame and common shaft for the motor and generator with ball bearings on the generator end and roller bearings on the motor end. A separate exciter is overhung from the motor end. The control units are mounted on the side of the set, in an integral part of the frame and protected by a sheet-steel panel. The Flexactor is mounted underneath the frame.

The welding unit illustrated has a rating of 300 amp., 1 hr., 50 deg. C. rise on resistance load at 25 volts in accordance with N.E.M.A. standard practice. The welding range of the unit is from 90 amp. to 375 amp. The generator is the standard Westinghouse SK type using constant current and is differentially wound and separately excited. A Linestart 15-hp. motor is used which operates on dual voltage, 220 or 440 volts, 25, 50 or 60 cycle, 2 or 3 phase. A 550-volt motor, 3 phase, 50 or 60 cycle, can also be used.

The generator field rheostat, ammeter and voltmeter, together with the motor starter, are all mounted in an enclosed sheet-metal cabinet which is an integral part of the unit frame. The capacities of the instruments are 600 amp. and 125 volts. The Westinghouse Linestarter motor control used is operated by a push button and has overload and low-voltage protection and is mounted in a steel cabinet. The exciter used in conjunction with the welding unit is the standard Westinghouse CD type, 125 volts, and is d.c., compound wound.

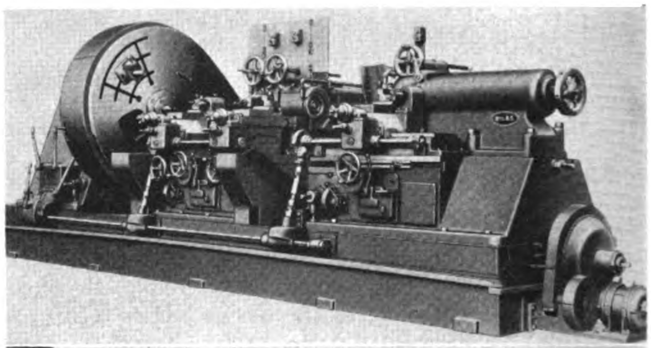
The 300-amp. single-operator welding unit weighs 2,000 lb. and is 60 in. long, 37 in. wide and 44 in. high. This welding unit is also built in a 200-amp. size.

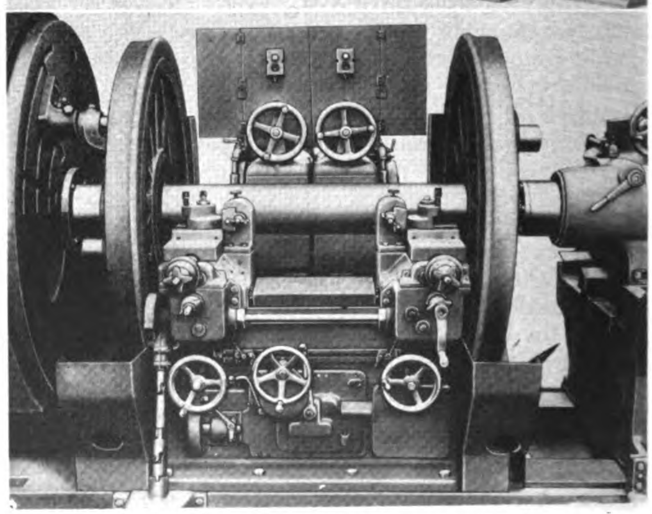
Niles Locomotive-Axle Journal Grinder

A MACHINE for grinding locomotive axle journals, which is arranged with a combination grinding and cutting rest for either independent or simultaneous refinishing of inside journals is shown in the illustration. This machine, which can also be arranged with a similar rest for finishing outside journals, is a recent addition to the line of products manufactured by the Niles Tool Works Company, Division General Machinery Corporation, Hamilton, Ohio.

The machine is arranged to swing wheel sets having 90-in. diameter drivers and to grind inside journals ranging from 12 in. to 18 in. in length. The grinding unit is located at the rear of the rest and the cutting tools at the front of the rest. The cutting tools are used for facing hub liners and for taking an initial cut over badly worn or scored journals so as to lessen the amount of material to be removed by the grinders.

In the design of the machine, precautions were taken to protect the wearing surfaces from the abrasive; de-





Top: General view of the Niles locomotive-axle journal-grinding machine—Bottom: The journal-grinding units

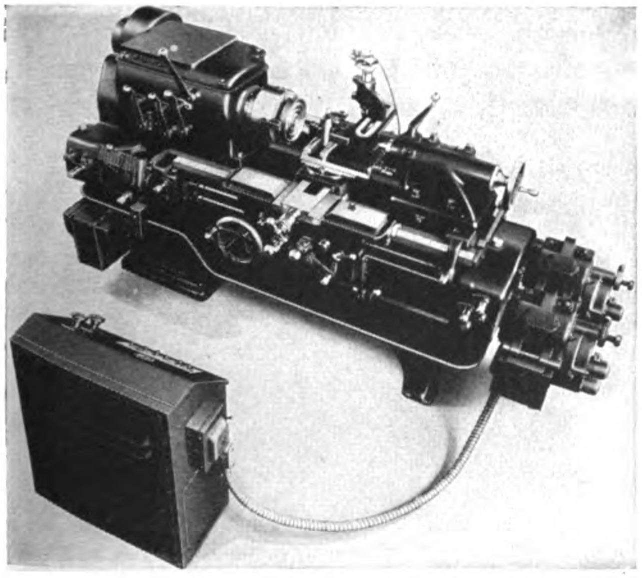
tailed attention being given to the control of the fluid compound and the proper collecting of this fluid in the bed for recirculation. Thirty minutes floor-to-floor production has been effected with this machine. One test installation of the machine was made in 1929 and the results obtained were such that two similar machines were installed during 1930. Wheel sets after operating 125,000 miles were removed for driving-box, hub-liner and tire repairs and were replaced without the necessity of regrinding the journals.

Monarch-Keller Form-Turning Lathes

THE Monarch Machine Tool Company, Sidney, Ohio, recently announced an arrangement with the Keller Mechanical Engineering Corporation, Brooklyn, New York, by which the two companies have collaborated in building a form-turning lathe. This machine combines the Keller electrical control units and the Monarch lathes, so that they are "built-in" to form a complete unit, for turning odd or irregular shapes.

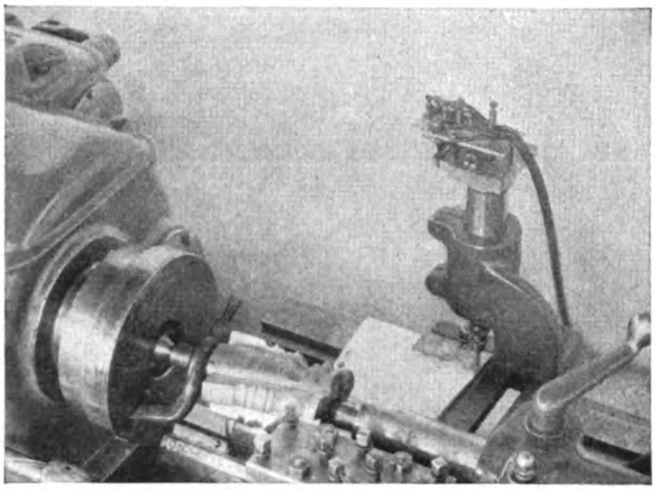
The Keller control unit consists of a tracing device, two Keller magnet boxes, and a control cabinet. The tracing device is mounted on the carriage of the machine and is always in a fixed relation to the cutting tool. A thin metal template, the outline of which represents the shape to be machined by the lathe, is mounted on a bracket at the back of the lathe, parallel to either the longitudinal or cross feed, depending upon the position of the work in the lathe, whether between centers or on a face plate. The tracer follows the template, and being magnetically controlled and attached to the carriage, it controls the movement of the cutting tool in and out. Thus, the tool follows the direction actuated by the tracer, making the shape in the lathe an exact replica of the template.

The magnet box of the controlling unit is geared to the feed rod of the lathe. The control unit is operated by a 14-volt control circuit and is opened or closed by the action of the tracer. A spring on the tracer contact lever holds the tracer normally in a closed position and closes the side of the 14-volt control circuit which energizes an "in" relay. The "in" relay engages a magnetic clutch which operates the cross feed in. When the machine is in operation, the cross feed is therefore normally running in. When the piece being machined requires the outward movement of the cross feed, the tracer following the template engages an "out" relay, engaging the "out" magnetic clutch which reverses the former direction of the cross feed. If the shape of the template should be parallel to the lathe bed, the tracer contacts will be neutral so that the lathe is turning a cylindrical shape.



A Monarch 18-in. by 6-ft. lathe equipped with the Keller control unit for turning odd- and intricate-shaped pieces

The Keller automatic control can be applied to all types of Monarch lathes. It must be mounted and wired



A spirally-fluted milling cutter machined to shape on the Monarch-Keller form-turning lathe—Note the tracer and template mounted on the lathe carriage

at the factory and, being a built-in feature, cannot be applied readily to lathes now in use. A lathe thus equipped is especially adapted for die and metal making and for turning odd- and intricate-shaped pieces.

Following are some of the classes of work which can be economically completed on these lathes: die casting dies; all classes of spinning chucks; punches and dies; composition mould dies; sheet-metal bending rolls; machining blanks for form-milling cutters; relieving spirally fluted form-milling cutters; and turning or facing special shapes in any form for which a thin master template can be made.

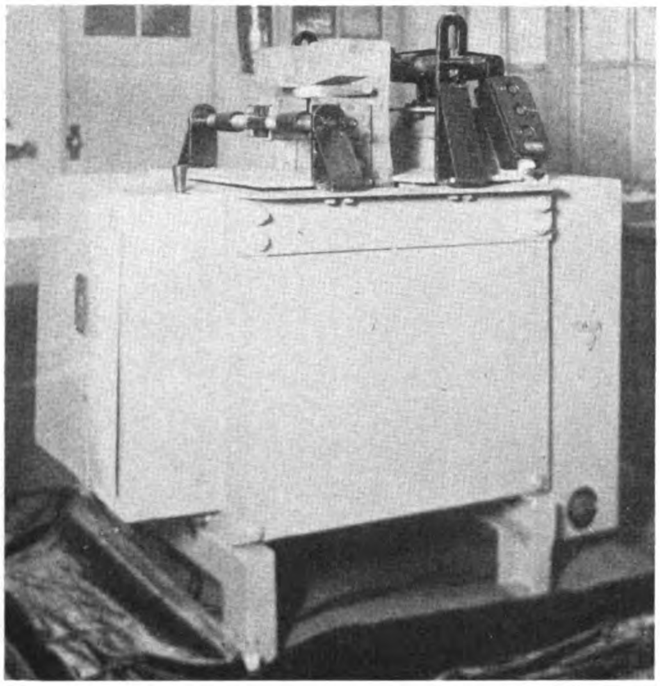
Berwick Electric Metal Heater

THE American Car & Foundry Company, New York, recently added to its line of products a heater built along the same general lines as the a.c.f. Berwick electric rivet heater, the new product differing in the fact that instead of having one path or two metal points for the current, there are two paths with four metal points. Two of the contact points form the lower electrode on which rests the piece to be heated. The lower electrode is in the same plane as the upper electrode, which has overhanging lips that press down on the upper portion of the periphery of the piece being heated, holding it in position during the heating process. The upper electrode, or secondary electrode, is in two halves, of horseshoe shape, and set as close as possible to a core of silicon steel.

The heater is constructed with the electrode in open view, thus permitting the operator to see clearly the piece of steel heating. It can be designed to specifica-

tions to obtain end heating, and also any desired length of heat at any spot on the bar or rod.

The time of heating depends entirely upon the size of transformer, the diameter of the stock to be heated, and the length of heat. A 1-in. steel bar, with a 6-in. length of heat, takes 1¼ min. per electrode. If a heater



The Berwick electric metal heater—Note the piece of round stock heating between the electrodes

were furnished with three electrodes, there should be three of these pieces per minute; if a heater were furnished with five electrodes, there should be five pieces per minute. Small sizes would be heated in less time, while larger pieces would take a longer period of time.

The electrical consumption usually runs from 18 to 20 kw.-hr. per hundred pounds of metal heated, but this is more or less dependent upon the period of time it takes to heat the stock. When heating long stock, of large diameter, the radiation of the piece during the process of heating may cause these figures to be increased.

Power Rail-Car Flange Oiling

EXCESSIVE wear on the flanges of power rail-car wheels, as well as those of electric locomotives, is said to be eliminated by application of a new design of oscillating control applied in connection with the locomotive flange oiler, made by the Hoofer Manufacturing Company, 4710 Armitage avenue, Chicago.

This flange oiler, of the pneumatic type, uses relatively inexpensive low-grade oil which is applied by means of oil shoes, each of which has an oil passage leading directly to the point on the flange where lubrication is most needed. Asphaltum road oil No. 3 is recommended for winter and No. 4 for summer, this oil being of a heavy consistency which causes it to adhere to the flanges and not congeal in cold weather.

The Hoofer equipment for oiling the flanges of power rail-cars, or similar electric-driven equipment, is shown in the illustration. In the cutaway section, at the upper right corner of the illustration, is shown the pressure-control valve, through which air passes from the main reservoir of the air-brake system to the Hoofer flange oiling equipment. The flange oiler itself is suspended from suitable brackets, rigidly bolted to the underframe of the car, flexible oil pipes leading to the oil shoes on the truck wheels. The oscillating control unit consists of a special valve actuated by a rod and bracket connection to the truck. The bracket connection to the truck frame, in central alinement with the bolster and center casting, is shown by the arrow at the right, and the swivel head, by means of which the quantity of oil delivered is adjusted to feed about one-half pint for each wheel per hundred miles, is indicated at the left arrow.

In operation, air pressure from the main reservoir, which may vary from 80 to 130 lb., is reduced at the pressure control valve to about 5 lb. in excess of the normal brake-pipe pressure. The design of the oscillating control unit is such that each time an oscillating movement takes place between the truck and the body of the vehicle, the control valve is opened, permitting a certain amount of air to pass to the flange oiler proper, operating the discharge pistons and carrying a certain amount of oil to the flanges. The flange

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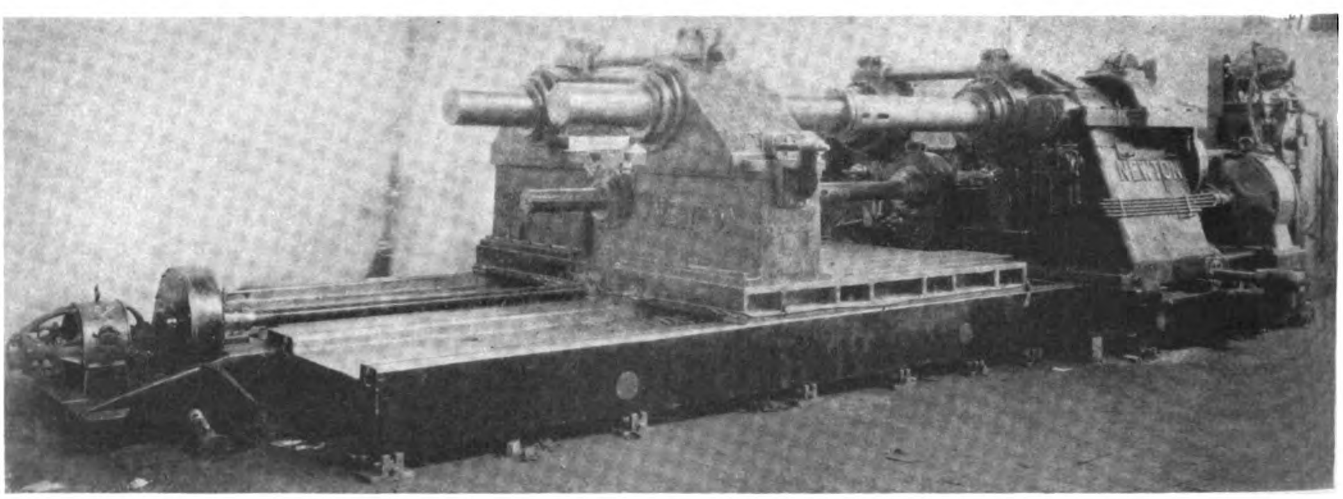
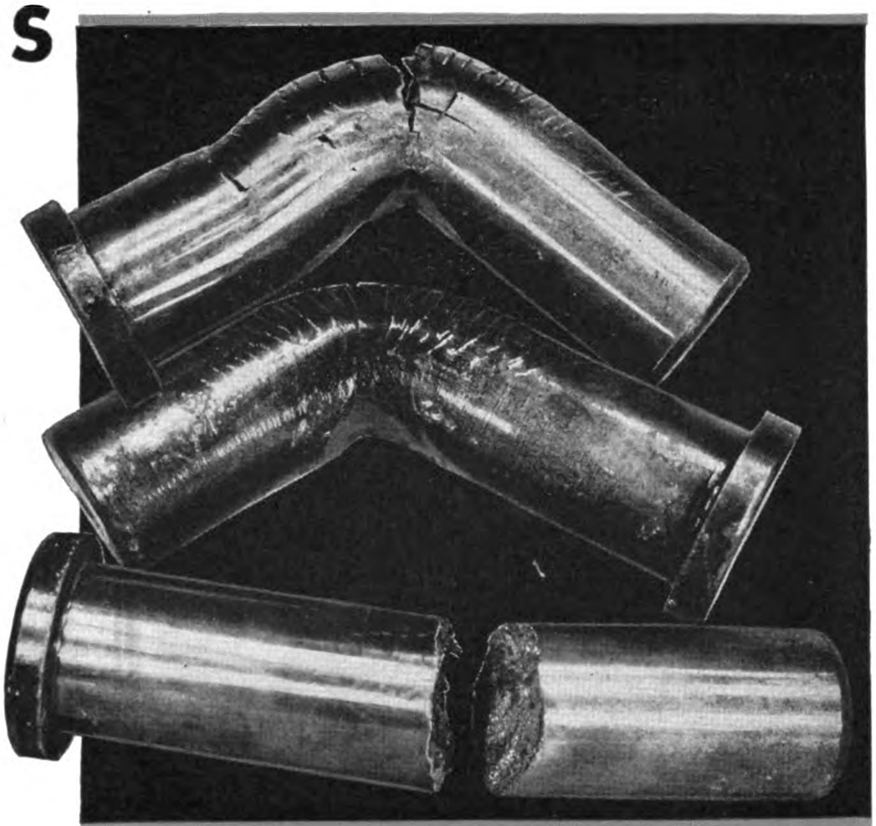


Newton three-spindle horizontal boring machine for facing and counterboring large fabricated welded-steel electric-motor frames

CASE-HARDENED PARTS NOW COST LESS

AGATHON NICKEL IRON



All three spring hanger pins were carburized for 8 hours, quenched in water and broken under a steam hammer. Note the toughness of the Agathon Nickel Iron.

AGATHON NICKEL IRON

Gives A Better Case At A Lower Cost

■ Alloy irons and steels developed by Republic metallurgists are already improving the service of many car and locomotive parts.

■ Now comes Agathon Nickel Iron to remove many case-hardening difficulties and reduce the cost of case-hardened parts.

■ Not only does this material take a fine case but the core is unusually tough and uniform. There are no slag spots or seams and warping is almost negligible.

■ With this improved material, pins and bushings may be machined to size, polished, carburized and quenched from the pot without spoiling the surface for smoothness.

■ Grinding is unnecessary and the finished cost with Agathon Nickel Iron is lower.

■ Wherever you use case-hardened pins and bushings try Agathon Nickel Iron.

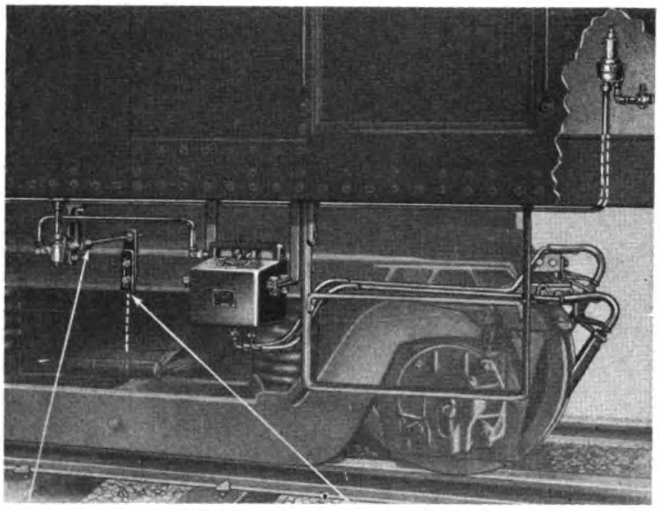
Central Alloy Steel Division

REPUBLIC STEEL CORPORATION

MASSILLON, OHIO

oiler, or lubricator, is equipped with four of these discharge pistons so that oil can be supplied to the oil shoes and flanges on both the front and back wheels for operation in either direction operation, if desired.

The adjustment of the swivel, or control head, at the left arrow, is made to suit the curvature of the track and regulate the frequency at which the lubricator will operate. The amount of oil discharged may also be regulated by feed nipples of greater or lesser capacity. A strainer, suitably located in the feed line to the operating valve, prevents scale and other foreign matter from interfering with its operation. The design of the lubricator, itself, also provides a mechanical means for clearing the restricted passages in the discharge piston and thus promotes reliability of operation. The oil shoe riggings are furnished with right and left shoes, which may be installed in either a declined or an inclined position, whichever is more convenient. The fact that the air current used in this flange oiler has been somewhat warmed during compression, and then passes with the oil through the oil lines and the oil shoes, contributes to the successful operation of the oiler in winter months.

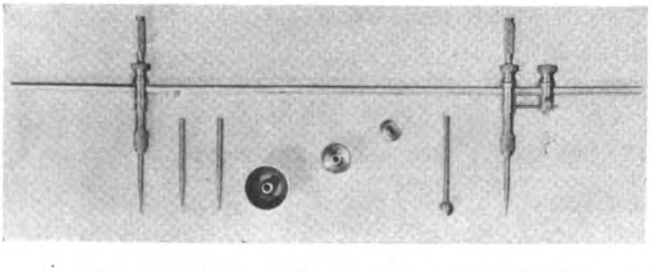


Hoofer flange oiler and oscillating control unit as applied to a power rail car

Starrett Trammels With Steel Beams

METAL workers draftsmen, lay-out men and others whose work demands precision in long measurements will be interested in a trammel now being manufactured by the L. S. Starrett Company, Athol, Mass.

The No. 251 Starrett trammel presents a number of refinements and improvements over old types. The beam is a steel rod, stiff enough to prevent the bending which often causes inaccuracy in wood-beam trammels. The beam is flattened on top so that the trams, once clamped in position, have no tendency to turn when pressure is applied to the points. As the illustration shows, one of the trams has an adjusting screw which permits fine adjustments. The setting of the points is made easy by the arrangement of a spring friction which holds the tram in place when the nuts are loosened.



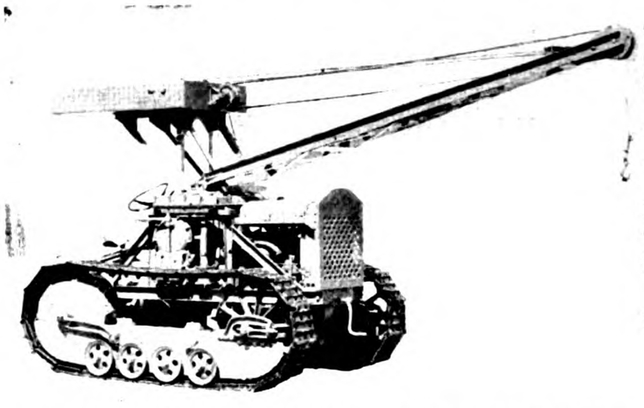
The No. 251 steel-beam Starrett trammel

An improvement which makes the trammels more accurate and at the same time makes them easier to use is the design of the knurled grips. These are in the form of rollers which turn freely with the fingers as the arc is scribed.

The trammed points are adjustable in the spring chucks. They can be replaced by pencils, caliper legs or ball points. The ball points permit working from holes up to 1½ in. in diameter. The trammel is supplied with steel beams of various lengths to scribe circles of 18 in., 26 in. and 36 in. in diameter. In addition, an extra 20-in. beam with a rigid coupling is obtainable, increasing the range of the tool to circles 72 in. in diameter.

Tractor-Mounted Roustabout Crane

THE Hughes-Keenan Roustabout Crane*, which is manufactured by the Hughes-Keenan Company, Mansfield, Ohio, has been adapted to the Model GU Trackson Allis-Chalmers crawler tractor. This combination is designed to provide a compact, flexible and easily operated crane unit that meets the needs of railroad shops and yards for spotting, lifting and transporting heavy or unwieldy weights such as wheels and other car parts, rail sections, large boxes, bales, and other freight, etc.



The Hughes-Keenan Roustabout crane mounted on a model GU Allis-Chalmers crawler tractor

Both the crawler tractor and the crane are constructed and designed for heavy duty. The Model GU Trackson Crawler is of open design with wide clearances. The boom of the Hughes-Keenan Crane is full-revolving, swinging in all directions through a complete circle, on a ball-bearing turntable, and is effective at all points because of the counterweight box which is mounted on the turntable. The boom can be raised and

* The Hughes-Keenan Roustabout Crane mounted on a truck for general shop use was fully described on page 230 of the May, 1930, issue of the *Railway Mechanical Engineer*.

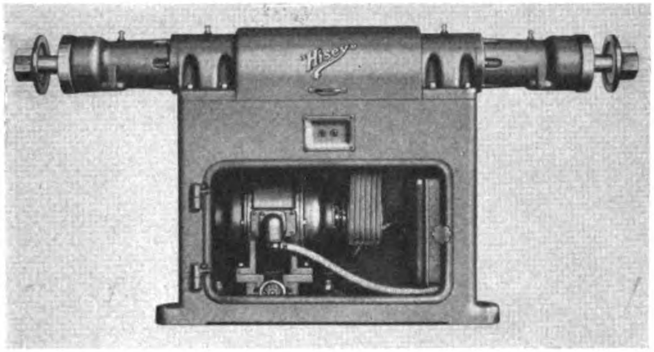
(Continued on next left-hand page)

lowered by power, enabling the unit to go through doorways, etc., and the load can also be lifted or lowered without moving the boom. The load is raised by a cable which is wrapped on a drum and which is independent of the cables that hold the boom in place.

The crane does not interfere with the use of the tractor for drawbar operations, therefore making the outfit an all-purpose power unit, which can be used for hauling, skidding, etc., as well as for crane work.

Hisey Buffing and Polishing Machine

A RECENT addition to the grinding machines marketed by the Hisey-Wolf Machine Company, Cincinnati, Ohio, is the heavy-duty Texdrive buffing and



The Hisey 10-hp. to 15-hp. Texdrive grinding machine

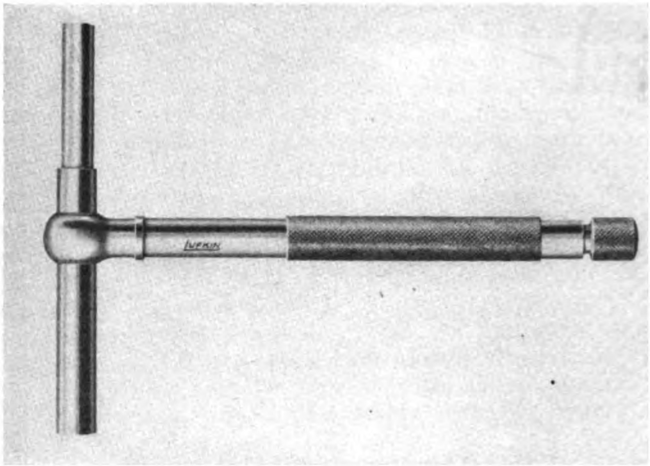
polishing machine shown in the illustration. The grinder has an overall spindle length of 82 in., projecting 15 in. at each end. It weighs 2,600 lb., and is furnished with either a 10-hp. or 15-hp. motor, as desired.

The motor of this machine is equipped with ball-bearings and mounted horizontally on a dovetailed sliding base. A belt tension and alinement of the motor is effected by hand-wheel and feed-screw adjustment. The spindle head is mounted on four ball bearings, Timken roller bearings being optional. The bearing boxes are keyed to the column of the machine, the key running along the entire base of the bearing housing to insure alinement. The wheel-arbor ends are finished with flat-top threads to afford greater security in holding the buffing wheel. They are also fitted with a Tobin bronze safety wheel nut to protect the thread and the operator.

Lufkin No. 79 Telescoping Gages

A TOOL for gaging the inside diameter of holes or slots which consists of two telescoping plungers attached to a handle which always locates itself in the center of the plungers, is a recent addition to the line of products marketed by the Lufkin Rule Company, Saginaw, Mich. The telescoping plungers can be locked by a slight turn of a knurled screw in the end of the handle of the gage which, by virtue of its central position on the plunger, permits the perfect balancing of the tool.

The ends of the plungers are hardened and ground to a radius in order to furnish clearance for the gage when it is inserted in the smallest hole it will enter. The tools are designated as the Lufkin No. 79 gages and are made in five sizes, ranging from the smallest which is



The Lufkin No. 79 telescoping gage

designed for use in holes of ½-in. to ¾-in. diameter to the largest which can be used in holes from 3½-in. to 6-in. in diameter.

To obtain a measurement, the plungers are compressed and locked after which the gage is inserted in the hole or slot. When the lock is released, the plungers expand to the exact size of the hole or slot. They are locked in that position and the gage is removed. The size of the hole is then measured by the use of an outside micrometer.

Buffalo Heavy-Duty Production Drill

THE 10-in. heavy-duty production drill shown in the illustration is the product of the Buffalo Forge Company, Buffalo, N. Y. It is constructed with a

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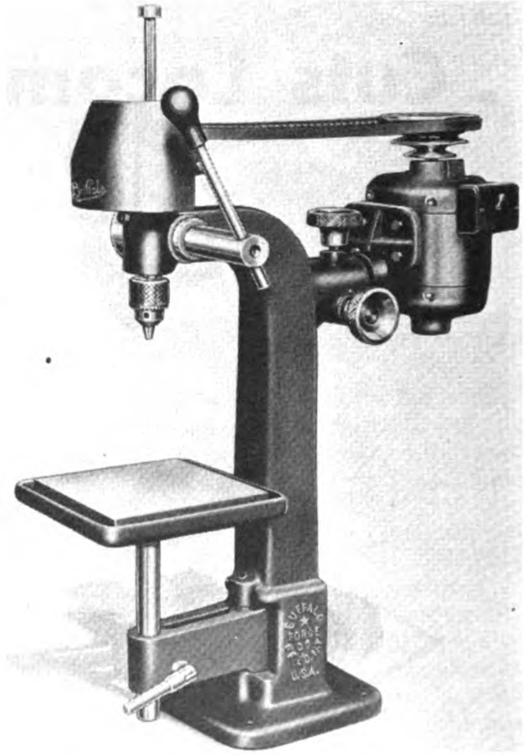


The Buffalo 10-in. heavy-duty drill

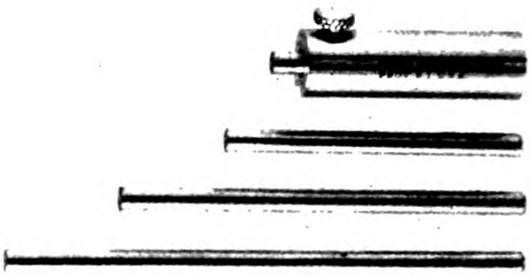
heavy box-column frame and bronze bearings throughout and is designed to fit the requirements of a large-range bench drill capable of production work.

The drill has a ½-in. capacity in cast iron and is designed to operate at spindle speeds of 3,000, 1,750 and 850 r.p.m. A vertical ball-bearing ¼-hp. motor, operating at 1,725 r.p.m., is mounted on the back of the box column frame. The spindle is fitted with a quick return spring and hand knobs are furnished for rack and pinion adjustment of the belt. The table has a 7-in. square working surface, designed with an oil trough. The drill is 32-in. high and the distance from the center of the column to the center of the drill measures 5⅛-in. The spindle travel of the drill is 3½-in., the maximum distance from the chuck to the table is 11½-in., while the vertical movement of the table is 10 in. Complete with the motor, the drill weighs 105 lb.

Brown & Sharpe Depth Gage

IN the illustration is shown a recently developed depth gage designated as the No. 599 gage by its manufacturers, the Brown & Sharpe Manufacturing Company of Providence, R. I. It is designed for checking the depth of holes, counterbores and distances between shoulders and flanges, having the advantage that it may be used against or between very small shoulders or in shallow recesses.

Depths from 0 in. to 2 in. by thousandths of an inch are obtained by measuring the overall length of the body and rod with a micrometer. From this measurement is subtracted the length of the body which is exactly 1 in. The rods are polished and the body is hardened and ground, and has a V-groove which facilitates measuring against a curved surface. When a measurement is taken, the setting is locked by the clamp screw.



The Brown & Sharpe No. 599 depth gage

If desired, the tool can be used to measure distances from 1 in. to 3 in. between shoulders, etc. and, where the tool is used for this purpose, the micrometer reading of the overall length is the correct dimension.

TEN YEARS AGO.—Car and locomotive prices reached a peak in 1920. Prices paid for locomotives in that year were two and one-half times the average prices for the years 1910-1914; for all-steel freight cars, three times; for freight cars of composite construction more than three times, and for passenger coaches more than twice.—Railway Age, January 7, 1921.

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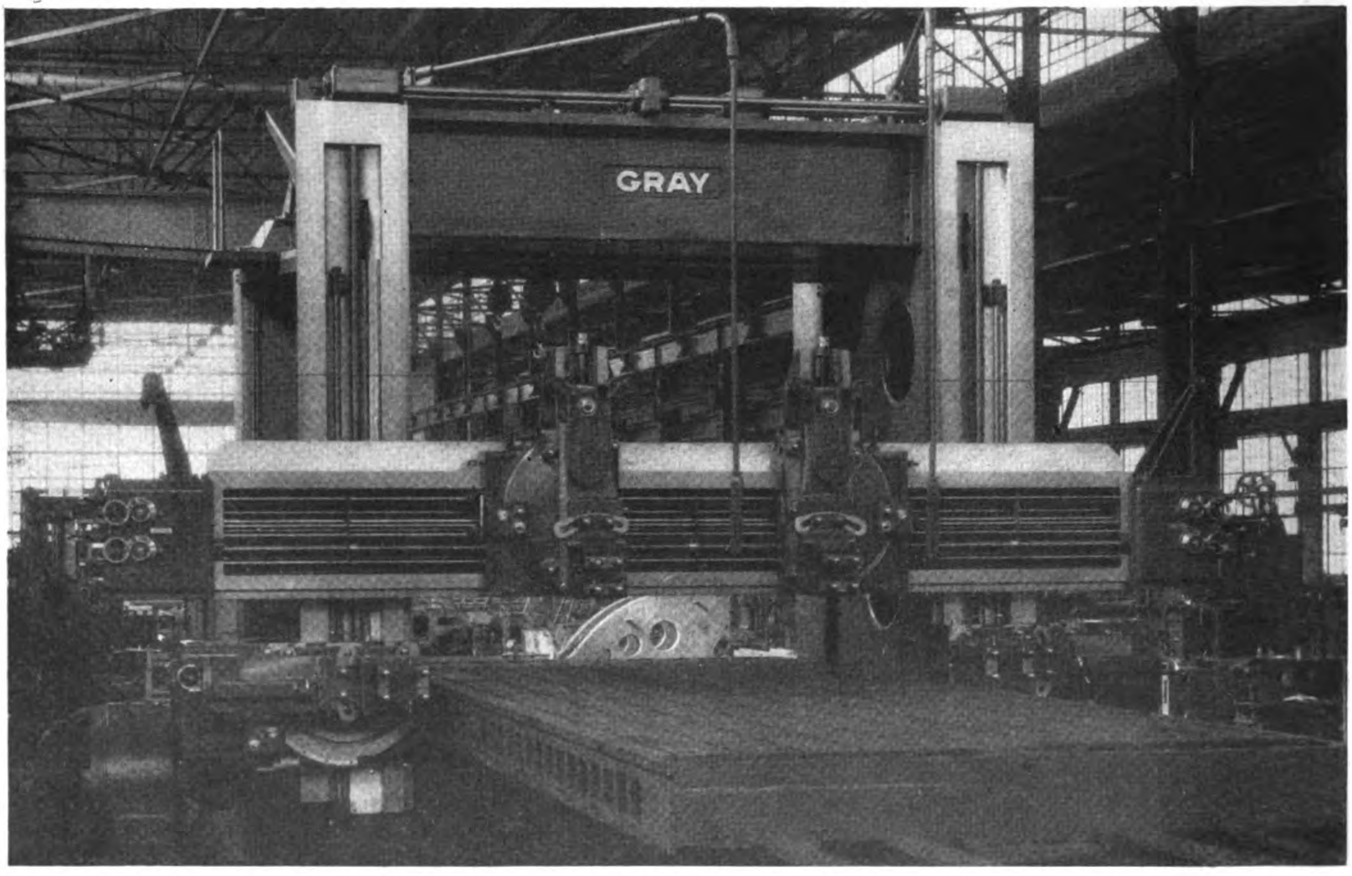
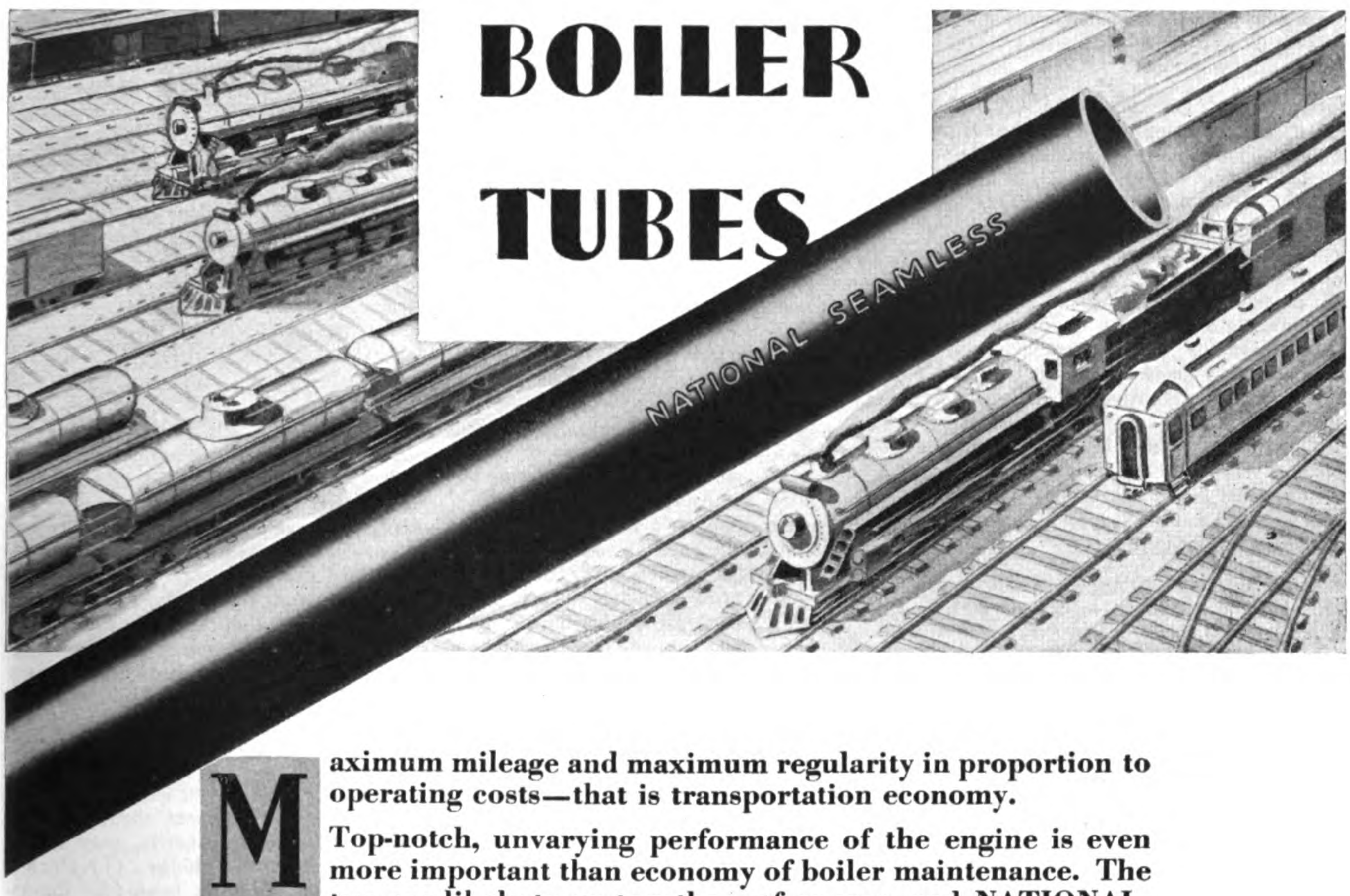


A 250-ton planer, built by the G. A. Gray Company, Cincinnati, Ohio, which is equipped with a 60-ton table capable of accommodating work 10 ft. high and 30 ft. long

ROLL UP THE MILEAGE

with GOOD

BOILER TUBES



Maximum mileage and maximum regularity in proportion to operating costs—that is transportation economy.

Top-notch, unvarying performance of the engine is even more important than economy of boiler maintenance. The two are likely to go together, of course, and NATIONAL-SHELBY Seamless Boiler Tubes go very far to assure both. For the same qualities that make them lasting, make them also highly immune to costly disablements, interruptions, and delays.

Ductility, toughness, and strength are worked into these tubes by employment of the expertness, the facilities, and the organization of the largest manufacturer of tubular products in the world. They resist pitting and fatigue, hold tight in the flue sheet, and give lasting, efficient service. Ask for Bulletin 12, describing NATIONAL-SHELBY—

America's Standard Boiler Tubes

NATIONAL TUBE COMPANY, PITTSBURGH, PA.

Subsidiary of United States Steel Corporation

US STEEL

NATIONAL SEAMLESS

Among the Clubs and Associations

CAR FOREMAN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—On March 12 at 2 p.m. E. R. Phillips, general foreman of the Chicago & North Western, Council Bluffs, Iowa, will present before the Car Foreman's Association of Omaha, Council Bluffs and South Omaha Interchange a paper on standard markings on wheels removed at all shops to facilitate checking of wheels by A.R.A. inspectors. This will be followed by a discussion of brake rigging on freight cars.

MECHANICAL DIVISION, A. R. A.—The twelfth annual meeting of the American Railway Association Mechanical division is scheduled to be held June 23, 24 and 25 at the Congress hotel, Chicago. This will be a business session with the proceedings largely limited to the reports of important standing committees. Other committees will present reports in case they have recommendations with an important bearing on economy and efficient operation. Plans are being made for one or two well-known railway executives to address the division. Railway supply men interested in the reports or the discussion will be welcome, but no entertainment features are scheduled and there will be no exhibition of equipment or supplies in connection with the convention.

PACIFIC RAILWAY CLUB.—S. T. Bledsoe, chairman of the Executive Committee of the Atchison, Topeka & Santa Fe, will be the guest of honor and principal speaker at the fourteenth annual meeting and banquet of the Pacific Railway Club which will be held on March 19 at the Fairmont Hotel, San Francisco, Cal. Briet addresses will also be delivered by Paul Shoup, president, Southern Pacific; H. M. Adams, president, Western Pacific; Edward H. Maggard, president, Northwestern Pacific; H. A. Mitchell, president, Sacramento Northern Railway Company; A. J. Lundberg, president, Railway Properties & Equipment Corporation, and Samuel Kahn, president, Market Street Railway Company. J. P. Potter, vice-president of the Key System, Ltd., and retiring president of the club, will be toastmaster, and entertainment will be furnished by the Southern Pacific concert orchestra. Officers for the coming year will be installed at this meeting.

Club Papers

Railroad-Shop Welding Practice

American Welding Society, New York Section.—Meeting held at the Engineering Societies Building, 29 West 39th Street, New York, Tuesday, February 24. Papers by E. V. David, Applied Engineering Department, Air Reduction Sales Company, and by George L. Young, boiler foreman, The Reading Company, Reading, Pa. ¶ Lengthening tender underframes with the oxyacetylene torch, the paper presented by Mr. David, appears in the Back Shop and Enginehouse section of this issue of the *Railway Mechanical Engineer.* ¶ The paper by Mr. Young reviewed the early application of welding in the railway field and discussed at length oxyacetylene and electric welding as practiced today by the Reading Company in its shops at Reading, Pa. ¶ In discussing welding applications to locomotive repairs, Mr. Young described the rebuilding of two Santa Fe type locomotives at the Reading shops. These locomotives were rebuilt from Mallet type locomotives and were ready for service in their rebuilt form seven weeks after the Mallets had been placed in the shop. ¶ It developed that these locomotives have two interesting features based on the welding art. The first of these are the tenders, which have a water capacity of 19,000 gal. and space for 26 tons of coal and which are completely electric welded. These tenders are equipped with Commonwealth underframes and six-wheel trucks. ¶ The other welding feature of these locomotives is the construction of the firebox which is entirely welded except that rivets are used in attaching the mud rings to the inside and outside sheets. The firebox and combustion chamber combined are 190¼ in. long, the firebox consisting of four sheets, the firebox sheet, door sheet, throat sheet and back flue sheet. The firebox sheet is made of ⅜-in. stock and is 185 in. wide by 230 in. long. The door sheet, throat sheet and back flue sheet are welded to the crown and side sheets. The seam of the combustion chamber is welded through the bottom of that chamber. ¶ In addition, there are three Nicholson Thermic syphons welded in place, two in the firebox and one in the combustion chamber. At the upper end they are welded to the crown sheet. The lower end of the combustion chamber syphon is welded to a diaphragm which is set in and welded to the bottom of the combustion chamber. The lower ends of the firebox syphons are welded into openings in the throat sheet. There is a total of 120 ft. 6¼ in. of welded seams in the construction of each boiler of these two Santa Fe type locomotives. This does not include the welding of the flues. ¶ In addition to these two important features of Mr. Young's paper, he discussed at length the training of welders, the use of young men for this purpose and the care which should be exercised in guarding the welders and men working adjacent to the electric arc.

Help Yourself by Helping the Railroads

St. Louis Railway Club.—Meeting held December 12 at St. Louis, Mo. Address by Col. F. W. Green, vice-president, St. Louis Southwestern, on "The Business Outlook." ¶ As an interesting sidelight on the present business depression and indicating that the problems now facing practically all industries, including the railroads, may be acute, but not new, Colonel Green called attention to the historical fact that in 1821 Governor Bates of Missouri deprecated legislation enacted by the Missouri legislature to relieve the acute depression caused by over-expansion in the east and ill-advised land speculation in the west. Colonel Green outlined some of the conditions which must be squarely faced by the railroads if they are to continue giving satisfactory service to the American public and earn a reasonable return on their investments. ¶ His address was concluded with the following highly pertinent paragraph: "Railroads work on a very narrow margin between income and outgo. Believe it or not, the welfare of the public is intimately related to the welfare of the railroads. It has been shown that over a long period of years, the curve of general prosperity and the curve of railroad prosperity run parallel. When railroads stop buying, prosperity wanes, and conversely. The reason for this is that the railroads rank at or near the top as consumers of bituminous coal, fuel oil, iron and steel, brass castings, lumber, cement, paints and varnishes, and so on. Prices fluctuate with demand. When the railroad demand stops, prices slump. If you want to help yourself, help the railroads, and if you want to help the railroads to do their part about bringing about a return of prosperity, may I suggest that you do two things: (1) Decline to permit yourself to be misled by fantastic economic theories, such as increasing wages to increase purchasing power, and (2) that you let your congressmen and senators know that you are interested in their helping to bring about return of prosperity and that, in your opinion, a quick way of bringing it about would be to permit transcontinental carriers to compete with ocean carriers operating through the Panama canal without reduction of rates to all intermediate points to the basis of the ocean terminal rates."

High-Test Alloy Cast Iron

Western Metal Congress, American Society for Steel Treating—Meeting held in San Francisco, February 16. Paper by Frank B. Coyle, Research Metallurgist, The International Nickel Company, Inc.,

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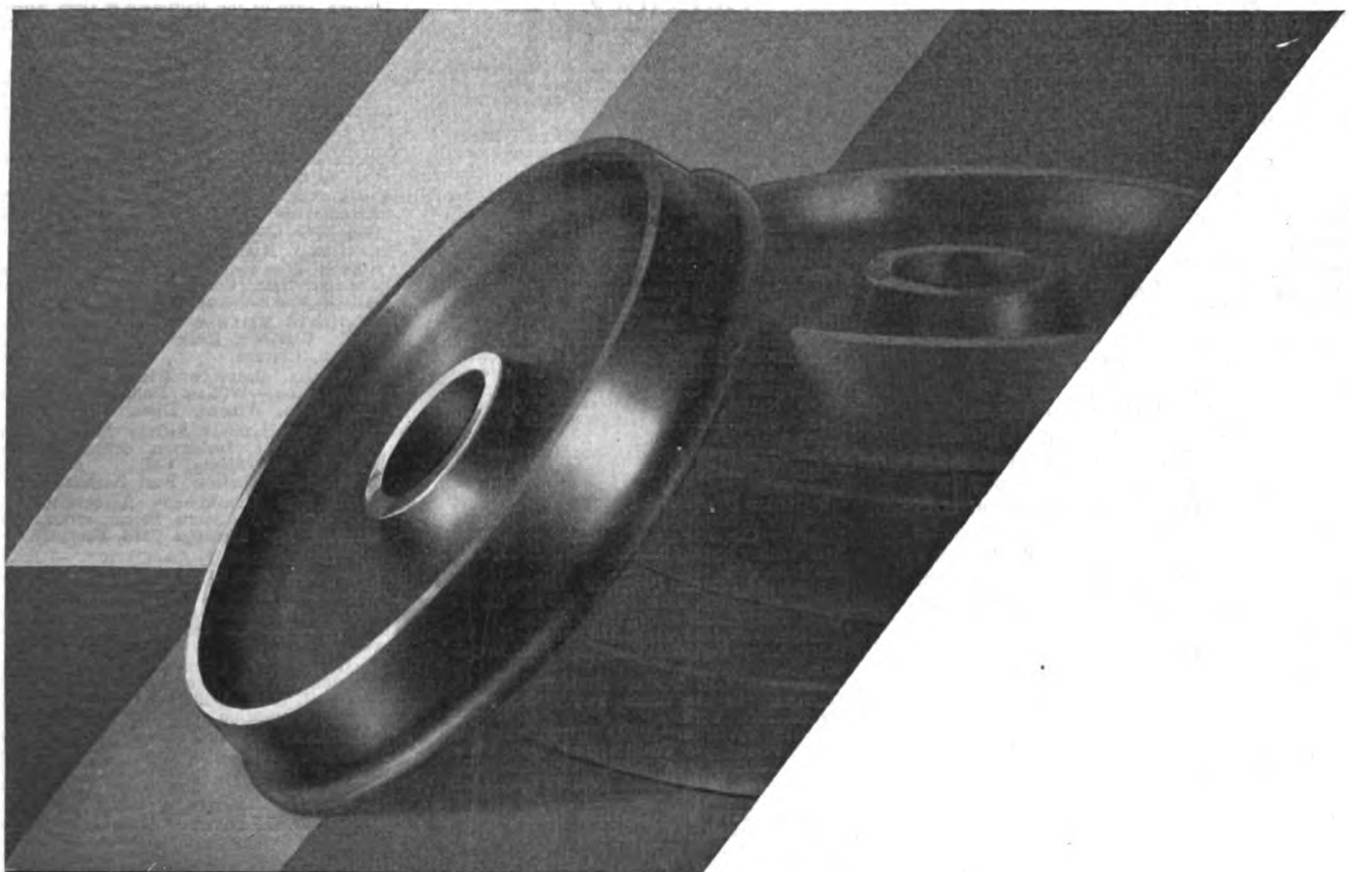

New York City. ¶Preventives have been developed in metallurgy to keep metals strong and healthy, just as in medicine to protect man. A "hypodermic" injection of nickel in molten gray cast iron prevents the metal from developing a weak structure. ¶"In all grades of gray cast iron," Mr. Coyle explained, "some free carbon is present in the form of graphite. These large graphite flakes, producing planes of weakness in the metal, are responsible for the relative weakness of gray cast iron. The weakening effect is reduced to a minimum by lowering the carbon content as much as practicable and injecting alloying elements—nickel, or nickel with chromium—to break up the existing flakes and to scatter the minute graphite particles throughout the metal. By this combination of effects, a strength nearly double that of ordinary cast iron is attained." ¶Mr. Coyle stated that it is generally considered that cast iron can be divided into four major groups, the basis of sub-division being its tensile strength. These sub-divisions and their range of tensile strengths are: common gray cast iron, under 30,000 lb. per sq. in; high-grade cast iron, 30,000 to 38,000 lb. per sq. in.; high-test cast iron, 38,000 to 50,000 lb. per sq. in.; high-strength cast iron over 50,000 lb. per sq. in. ¶Mr. Coyle limited his paper to the discussion of the production of high-test cast iron and its alloys with nickel and nickel with chromium. This type of gray iron, he pointed out, can be produced in any foundry if reasonable care and watchfulness are observed. He then discussed the necessary procedure to be followed for the production of this type of cast iron. ¶Mr. Coyle referred in the latter part of his paper to alloy additions to cast iron, stating that "it has been found that alloys, particularly nickel, or nickel and chromium, produce maximum quality in high-test cast iron." This product with a carbon range of 2.7 per cent to 3.15 per cent can be produced, he stated, with a tensile strength of 38,000 to 49,000 lb. per sq. in.; a transverse strength of 4,200 lb. to 5,600 lb. per sq. in.; a Brinell hardness of 200 to 240 and a deflection of .15 to .20 in. Referring to the use of high-test cast iron alloyed with nickel, as compared with regular cylinder iron for use in locomotive cylinder castings, Mr. Coyle stated that the alloy high-test iron with a nickel content of 1 per cent. to 1.25 per cent has a tensile strength of 37,500 to 46,100 lb. per sq. in., as compared with 26,000 to 32,000 lb. per sq. in. for the regular cylinder iron. The regular cylinder iron has 2,200 to 3,000 lb. per sq. in. transverse strength, 160 to 170 Brinell hardness and a deflection of .17 to .18 in. ¶Mr. Coyle said that high-test gray iron in the 38,000 lb. to 50,000 lb. per sq. in. range of tensile strength is particularly applicable to medium and heavy castings where the combination of strength and resistance to wear are essential. Applications for the high-test alloy cast iron, he said, includes the following: locomotive cylinders, bushings, pistons and rings; machine-tool beds and tables; valve bodies, hydraulic-press plungers, hammer frames, gears, brake drums, pumps, and Diesel engine parts.

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

AMERICAN RAILWAY ASSOCIATION.—DIVISION V. —MECHANICAL.—V. R. Hawthorne, 59 East Van Buren street, Chicago. Meeting June 23, 24 and 25, Congress Hotel, Chicago.
DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago.
DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey street, New York.
DIVISION I. — SAFETY SECTION. — J. C. Caviston, 30 Vesey street, New York.
DIVISION VIII.—CAR SERVICE DIVISION.—C. A. Buch, Seventeenth and H streets, Washington, D. C.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.
RAILROAD DIVISION.—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York. Spring meeting April 20-23, Birmingham, Ala.
MACHINE SHOP PRACTICE DIVISION. — Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.
MATERIALS HANDLING DIVISION.—M. W. Potts, Alvey- Ferguson Company, 1440 Broadway, New York.
OIL AND GAS POWER DIVISION.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.
FUELS DIVISION.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

ASSOCIATION OF RAILWAY SUPPLY MEN.—J. W. Fogg, MacLean-Fogg Lock Nut Company, 2649 N. Kildar avenue, Chicago. Meets with International Railway General Foremen's Association.

BOILER MAKER'S SUPPLY MEN'S ASSOCIATION.—Frank C. Hasse, Oxweld Railroad Service Company, 230 N. Michigan avenue, Chicago. Meets with Master Boiler Makers' Assoc.

CANADIAN RAILWAY CLUB.—C. R. Crook, 2276 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month except in June, July and August, at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT OFFICERS ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 3001 West Thirty-ninth Place, Chicago, Ill. Regular meeting, second Monday in each month, except June, July and August, Great Northern Hotel, Chicago, Ill.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 608 South Main street, Los Angeles, Cal. Meetings second Monday of each month except July, August and September, in the Pacific Electric Club building, Los Angeles, Cal.

CAR FOREMAN'S ASSOCIATION OF OMAHA, Council Bluffs and South Omaha Interchange.—Geo. Kriegler, car foreman, Chicago, Burlington & Quincy, Sixteenth avenue and Sixth streets, Council Bluffs, Iowa. Regular meetings, second Thursday of each month at Council Bluffs.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—F. G. Weigman, 720 North Twenty-third street, East St. Louis, Ill. Regular meeting first Tuesday in each month, except July and August, at American Hotel Annex, St. Louis, Mo.

CENTRAL RAILWAY CLUB OF BUFFALO.—T. J. O'Donnell, executive secretary, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meeting, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

CINCINNATI RAILWAY CLUB.—D. R. Boyd, 453 East Sixth street, Cincinnati. Regular meeting second Tuesday, February, May, September and November.

CLEVELAND RAILWAY CLUB.—F. L. Frericks, 14416 Adler avenue, Cleveland, Ohio. Meeting second Monday each month, except July, August and September, at the Auditorium, Brotherhood of Railroad Trainmen's building, West Ninth and Superior avenue, Cleveland.

EASTERN CAR FOREMEN'S ASSOCIATION.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings fourth Friday of each month, except June, July, August and September.

INDIANAPOLIS CAR INSPECTION ASSOCIATION.—E. A. Jackson, Box 22, Mail Room, Union Station, Indianapolis, Ind. Regular meetings first Monday of each month at Hotel Severin, Indianapolis, at 7 p.m. Noon-day luncheon 12:15 p.m. for Executive Committee and men interested car department.

INTERNATIONAL RAILROAD MASTER BLACKSMITH'S ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

INTERNATIONAL RAILROAD MASTER BLACKSMITH'S SUPPLY MEN'S ASSOCIATION.—J. H. Jones, Crucible Steel Company, of America, 650 Washington boulevard, Chicago.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash street, Winona, Minn.

INTERNATIONAL RAILWAY SUPPLY MEN'S ASSOCIATION.—W. J. Dickinson, acting secretary, 1703 Fisher building, Chicago. Meets with International Railway Fuel Association.

LOUISIANA CAR DEPARTMENT ASSOCIATION.—L. Brownlee, 3730 South Prieur street, New Orleans, La. Meetings third Thursday.

MASTER BOILERMAKER'S ASSOCIATION. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

MASTER CAR BUILDERS' AND SUPERVISORS' ASSOCIATION.—See Car Department Officers Association.

NATIONAL SAFETY COUNCIL—STEAM RAILROAD SECTION: W. A. Booth, Canadian National, Montreal, Que. William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting, second Tuesday in each month, excepting June, July, August and September. Copley-Plaza Hotel, Boston.

NEW YORK RAILROAD CLUB.—Douglas I. McKay, executive secretary, 26 Cortlandt street, New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York.

PACIFIC RAILWAY CLUB.—W. S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

PUEBLO CAR MEN'S ASSOCIATION.—I. F. Wharton, chief clerk, Interchange Bureau, Pueblo, Colo.

RAILWAY BUSINESS ASSOCIATION. — Frank W. Noxon, 1124 Woodward building, Washington, D. C.

RAILWAY CAR MEN'S CLUB OF PEORIA AND PEKIN.—C. L. Roberts, chief clerk, Peoria & Pekin Union Railway, 217 Lydia avenue, Peoria, Ill.

RAILWAY CLUB OF GREENVILLE.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meetings third Tuesday of each month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Regular Meeting fourth Thursday in month, except June, July and August. Ft. Pitt Hotel, Pittsburgh, Pa.

RAILWAY EQUIPMENT MANUFACTURERS' ASSOCIATION.—F. W. Venton, Crane Company, 836 South Michigan avenue, Chicago. Meets with Traveling Engineers' Association.

RAILWAY FIRE PROTECTION ASSOCIATION.—R. R. Hackett, Baltimore & Ohio, Baltimore, Md.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, June, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

SUPPLY MEN'S ASSOCIATION. — E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division, American Railway Association.

SUPPLY MEN'S ASSOCIATION.—Bradley S. Johnson, W. H. Miner, Inc., Chicago. Meets with Car Department Officers Association.

TRAVELING ENGINEERS' ASSOCIATION. — W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio.

WESTERN RAILWAY CLUB.—W. J. Dickinson, 343 South Dearborn street, Chicago. Regular meetings, third Monday in each month.

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NEWS

Bethlehem Pours a 230-Ton Steel Casting

IT IS REPORTED THAT the largest steel casting ever poured has been produced in the Lehigh plant of the Bethlehem Steel Company at Bethlehem, Pa. The casting is a platen, or cylinder jacket, for the 14,000-ton forging press at the Bethlehem plant and has a height of 12 ft. 10 in., a length of 23 ft. 4 in., and width of 10 ft. 2 in. It weighs 460,000 lb. Six open-hearth furnaces were required to melt the steel. In pouring, the mold was filled in approximately 10 min. and the total time, including the filling of the sink-heads during the cooling of the metal in the mold, required 38 min. The casting was allowed to cool in the mold ten days before cleaning was attempted.

Cloverport Protests Loss of Shops

THE LOUISVILLE, HENDERSON & ST. LOUIS and the Louisville & Nashville, which acquired the former in 1930, have filed a suit in the federal district court at Louisville, Ky., to restrain the City of Cloverport (Ky.) from forcing the railroad to maintain shops in that city. The city alleges that in April, 1894, it paid the Louisville, Henderson & St. Louis $20,000, in return for which the railroad agreed to maintain shops there permanently. The city not only asks for the return of the $20,000, but seeks $30,000 in interest. Plans for the consolidation of the facilities of the two roads contemplate the abandonment of mechanical facilities at Cloverport and the railroad holds that their retention would be a hindrance to interstate commerce.

Equipment Installed

NEW FREIGHT CARS installed in service by the railroads in 1930 totaled 76,909, according to reports compiled by the Car Service Division of the American Railway Association. This was a reduction of 7,985 cars under the number placed in service in 1929, but an increase of 18,514 cars above 1928 and 1,523 cars above 1927. Box cars totaled 40,042; coal cars 27,911; refrigerator cars, 3,974; flat cars, 3,668; stock cars, 913, and miscellaneous cars, 401. The railroads in 1930 also installed 782 new locomotives, compared with 762 in 1929; 1,390 in 1928, and 1,955 in 1927.

New freight cars on order on January 1, 1931, totaled 9,821, of which box cars totaled 4,357; coal cars, 3,278; refrigerator cars, 1,543; stock cars, 500, and flat cars, 143. On January 1, 1930, the railroads had 34,581 new freight cars on order, and on January 1, 1929, there were 13,036 on order. New locomotives on order January 1, 1931, totaled 120 compared with 431 on January 1, 1930, and 147 on January 1, 1929.

Research Graduate Assistantships

NOMINATIONS to the fourteen research graduate assistantships at the Engineering Experiment Station, University of Illinois, Urbana, Ill., will be made this year as usual from applications received by the director of the station not later than April 1. These assistantships, for each of which there is an annual stipend of $600 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics, or applied chemistry. An appointment to the position of research graduate assistant is made and must be accepted for two consecutive collegiate years of ten months each, at the expiration of which period, if all requirements have been met, the degree of Master of Science is conferred. Additional information concerning these assistantships may be obtained by writing the director of the station at Urbana.

Combination Rail-Highway Vehicle Developed in Britain

A COMBINATION motor vehicle interchangeable for operation on either rails or highways has recently been developed in Great Britain. The vehicle, designated "Ro-Railer" and manufactured by Karrier Motors, Ltd., was recently tested on a branch line of the London, Midland & Scottish. These tests were conducted with a vehicle having a motor coach body. In the accompanying illustration, it will be seen, the vehicle is fitted with a tractor body; thus the "Ro-Railer" is designed for both passenger and freight service on light traffic branch lines.

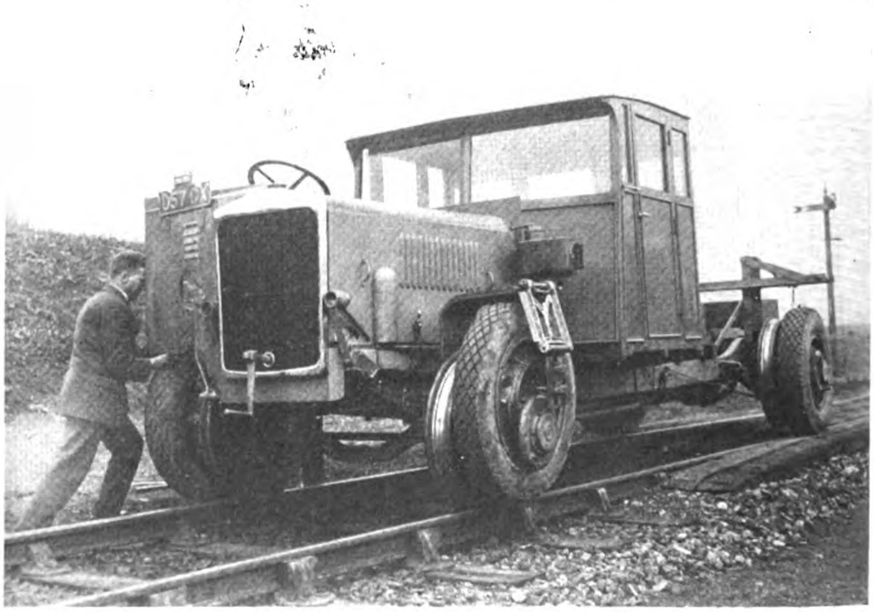
The vehicle is so constructed that the change from rail to highway operation or vice versa may be effected at any level crossing. Only two or three minutes are required for this change. When the vehicle is on the highway the flanged wheels are locked concentrically to the road wheels but, being of small diameter, these rail wheels are clear of the road wheels and of the rail when the vehicle runs onto the crossing for a change from highway to rail operation. As the vehicle leaves the highway to proceed by rail its weight is transferred from the highway wheels to the rail wheels as the former leave that portion of the railway which has been built up to the level of the highway.

The highway wheels are so fitted that the driver by the turn of a lever may raise them clear of the rail level and lock them to the chassis. Thus, when the "Ro-Railer" is operating on rails, only the flanged wheels revolve while the highway wheels remain locked in position. For a return to the highway the operation is reversed.

Sir Charles Parsons Inventor of Steam Turbine Dies

THE DEATH of the Honorable Sir Charles Parsons, the inventor of the well-known Parson's turbine, on February 11 at the age of 76 will be of interest to many readers of the *Railway Mechanical Engineer*. Sir Charles, who was made a Knight Commander of the Bath in 1911, was the first British engineer to receive the Order of Merit which was awarded in June, 1927. He held honorary degrees from various universities and was awarded the Rumford and Copley medals by the Royal Society; the Albert medal, Royal Society of Arts; the Faraday medal, Institution of Electrical Engineers, and the Kelvin medal.

Sir Charles was best known in this country as the inventor and developer of



The "Ro-Railer" with tractor body

the steam turbine in connection with the generation of electricity and ship propulsion. In addition to this work, he conducted many researches and experiments, especially pertaining to the effect of high pressures and temperatures on chemical action and the physical condition of materials. In addition to his many engineering activities, he served on a number of committees in England during the war and was an original member of the Advisory Council of the Department of Scientific and Industrial Research.

Hose-Coupling Screw Threads —Proposed Standard

THE PROPOSED AMERICAN STANDARD for hose-coupling-screw threads for all connections having nominal inside diameters of 1/2, 5/8, 3/4, 1, 1 1/4, 1 1/2 and 2 inches has been released for general criticism and comment. This proposal includes the form and pitch of the thread in addition to dimensional tables for hose couplings for steam, water and air services (fine threads); and hose couplings for certain other applications (coarse threads).

This proposed standard has been developed by the Sectional Committee on the Standardization of Screw Threads for Hose Couplings for which The American Society of Mechanical Engineers is the sponsor body. This committee, organized under the procedure of the American Standards Association, consists of 26 members representing 20 national organizations. The proposed standard is in tentative form for discussion and suggestions will be welcomed. They should be addressed to C. B. LePage, Assistant Secretary, The A.S.M.E., New York.

Thirteen Million Man-Hours

FOUR SHOPS of the Southern have been run for 4,681 shop days without a reportable casualty, which, says Lew R. Palmer, who reports the figures for the National Safety Council, is an all-American railroad shop record. The shops are those at Birmingham, Ala. (Finley shop), Selma, Ala., Hayne, S. C., and Lawrenceville, Va. The last casualty recorded at Lawrenceville was on August 21, 1926; at Hayne, June 25, 1927; at Selma, February 4, 1928, and at Finley shop, December 19, 1928. The total number of man-hours worked in the respective shops since those dates, up to January 1, 1931, has been 13,110,578.

Supply Trade Notes

THE CARNEGIE STEEL COMPANY has opened an office in the Atlas building, Columbus, Ohio.

H. W. ANDERSON has been elected assistant secretary of Whitman & Barnes, Inc., Detroit, Mich.

THE PRATT & WHITNEY COMPANY is now represented by the Smith, Booth, Usher Company at Los Angeles, Cal.

THE FROST RAILWAY SUPPLY COMPANY has moved its offices from the Penobscot building to the Union Guardian building, Detroit, Mich.

THE WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J., has moved its St. Louis district sales office to 1703 Ambassador building.

A. N. WILLSIE, of the Badeker Manufacturing Company, Chicago, has been elected president of that company, succeeding B. R. Alley, resigned.

THE TRUSCON STEEL COMPANY, Youngstown, Ohio, has moved its Minneapolis, Minn., offices from 611 Metropolitan Bank building to 344 Baker building.

THE CORLEY-DEWOLFE COMPANY, Elizabeth, N. J., has appointed the Great Lakes Supply Company, Chicago, its agent for railroads and industries in that district.

W. W. HANCOCK, formerly vice-president of the Donner Steel Company, has been appointed secretary of the Republic Steel Corporation, Youngstown, Ohio, to succeed Richard Jones, Jr.

G. H. WAITE, representative of the American Steel & Wire Co. with headquarters at Kansas City, Mo., has been promoted to manager of sales with the same headquarters.

R. M. CHESTER has been appointed general sales manager of the Neely Nut & Bolt Company. Mr. Chester's headquarters is in the general offices of the company at Pittsburgh, Pa.

C. B. MURPHY, special representative of the Diesel Engine division of Fairbanks Morse & Co. at Washington, D. C., has been appointed manager of stationary Diesel engines sales at Chicago.

J. C. KEENE, special representative, Bradford Corporation, has also been appointed manager of railway sales, midwest district, Durametallic Corporation, with offices in the Pure Oil building, 35 E. Wacker drive, Chicago.

N. J. KAMEN, formerly of the Alemite Corporation, has been appointed a representative of the Edna Brass Manufacturing Company, Cincinnati, Ohio. Mr. Kamen's headquarters are at Chicago.

FRED S. WILCOXEN, formerly associated with the Edna Brass Manufacturing Company, Cincinnati, Ohio, has been elected vice-president of the Standard Locomotive Equipment Company, 1316 McCormick building, Chicago.

THE WEST ALLIS FUEL & SUPPLY COMPANY, West Allis, Wis., has been appointed distributors in Milwaukee and Waukesha counties, of the products of the General Refractories Company, Philadelphia, Pa.

W. NEWTON JEFFRESS, INC., railway specialties and supplies, has moved his headquarters from the National Press building, to the Woodward building Fifteenth and H streets, N. W., Washington, D. C.

ARTHUR W. BARTH, vice-president and secretary of Henry Giessel Company, Inc., Chicago, has been elected president to succeed Henry Giessel, deceased. D. R. Rader, assistant secretary, has been appointed secretary.

L. R. CONOLLY, sales engineer, of the MacLean-Fogg Lock Nut Company, Chicago, has been granted leave of absence to serve as representative of the department of Exhibits, Chicago World's Fair Centennial Celebration in 1933.

THE BETHLEHEM STEEL COMPANY has acquired the business and properties of the McClintic-Marshall Corporation. G. H. Blakeley, vice-president of the Bethlehem Steel Company, now becomes president of the McClintic-Marshall Corp.

CHESTER G. CUMMINGS, for a number of years associated with the New York office of the Sullivan Machinery Company, with headquarters at Syracuse, N. Y., has been appointed manager of the branch office in the Rockefeller building, Cleveland, Ohio, vice R. T. Stone, resigned.

THE AMERICAN HOIST & DERRICK COMPANY, St. Paul, Minn., the Dominion Bridge Company, Ltd., and the Dominion Engineering Works, Ltd., Montreal, Que., have formed the Dominion Hoist & Shovel Company, Ltd., a subsidiary company, to manufacture and sell the products of the former company in Canada and the British Empire.

S. H. TAYLOR, JR., has been placed in charge of the Pacific Coast office of the Lincoln Electric Company, with headquarters at Los Angeles, Cal., to succeed W. S. Stewart, who has been appointed district manager of the Cleveland territory.

(Continued on second left-hand page)

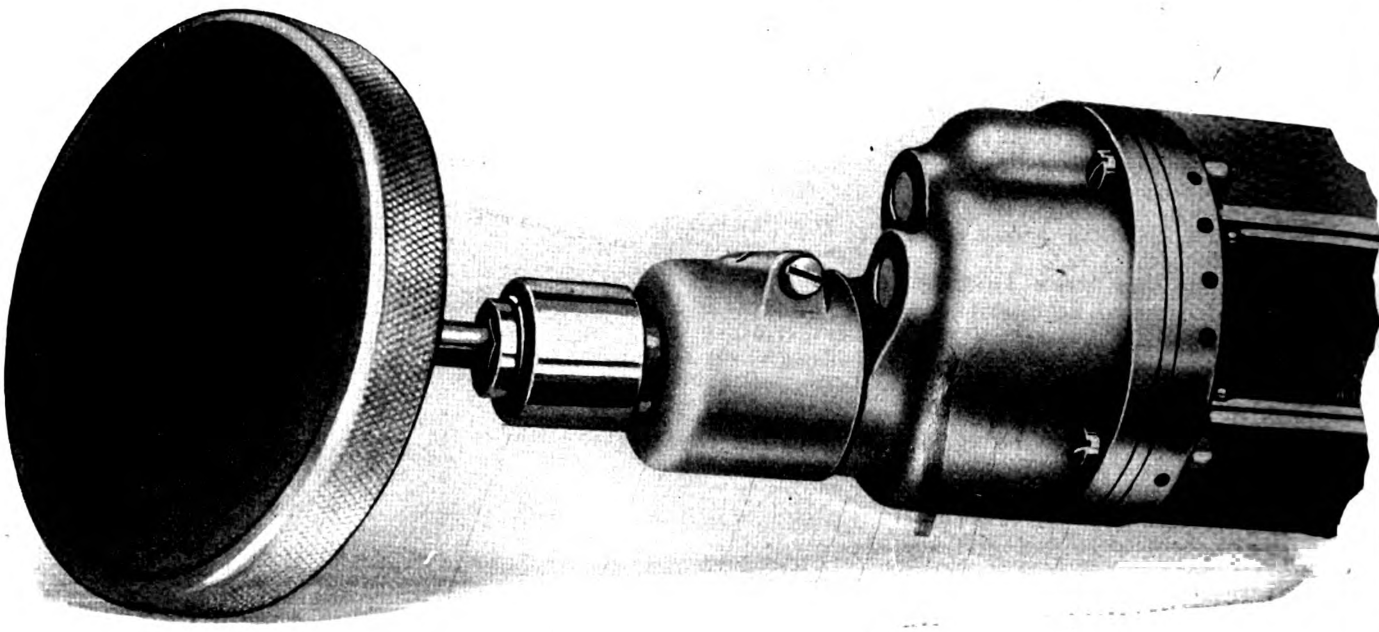
Domestic Orders Reported During January and February, 1931

Locomotives

Name of Company	Number ordered	Type	Builder
	January		
Inland Steel Co.	2	0-6-0	American Loco. Co.
	February		
Chicago & Illinois Midland	2	2-10-2	Lima Loco. Works
	1	2-8-2	Lima Loco. Works
Western Pacific	5	2-8-8-2	Baldwin Loco Works
Total for month	8		

Freight Cars

Name of Company	Number ordered	Type	Builder
The Inland Steel Co.	15	Ingot	Lorain Steel Co.
Byllesby Engineering & Management Corp.	2	Gondola	General American Car Co.
Freedom Oil Works Co.	7	Tank	Std. Tank Car Co.
Total for month	24		



ALCO
DUCHESNE RUBBING HEAD

THE Duchesne Rubbing Head is the result of over two years effort by this company to perfect a method whereby costly hand rubbing could be eliminated.

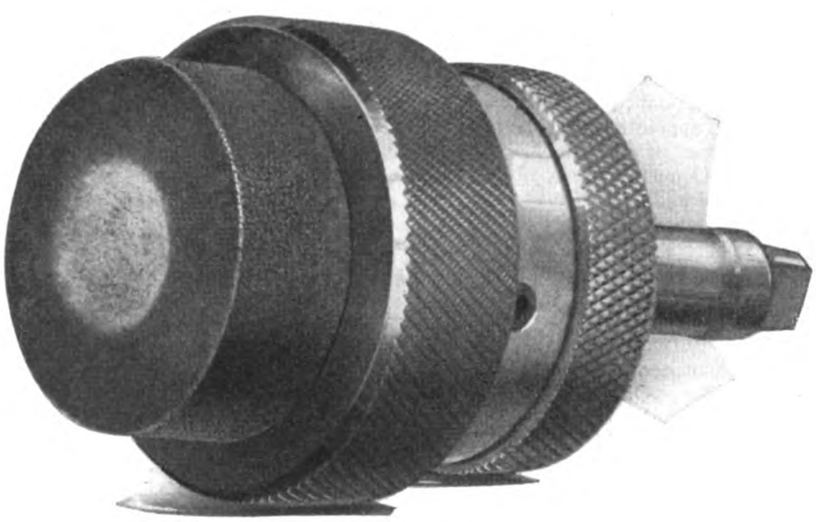
After the adoption of this tool for our own use, the superior finish it gave attracted immediate attention and demands were made for it. We have since standardized all heads and parts to meet an ever increasing demand.

In its present form all heads are the same design. The various discs and rubbers meet every condition encountered on railway equipment which must be finished. The rubbing element is secured by a half turn sleeve nut permitting quick removal. The body is chucked, in an air or electric motor by a positive, but flexible drive which makes even contact of rubbing element at any angle it is held by operator.

There is a plain surfacing head for all flat or convex surfaces. It carries a load of six specially formed waterproof abrasive discs which are peeled off one by one as they wear out.

The depressed center surfacing head is for flat surfaces around rivets or similar obstructions, identical in design except for a depression in the center to clear a rivet head with the same discs except for a hole in the center to pass over rivet.

AMERICAN LOCO
30 CHURCH STREET



ROY E. GREENWOOD, formerly associated with the Simonds Saw & Steel Company, has been appointed assistant general manager of sales of the American Chain Company, Inc., and associate companies, Bridgeport, Conn. Mr. Greenwood will have his headquarters at Bridgeport.

WILLIAM L. BROWN, formerly Philadelphia district sales manager for the Industrial Works, Bay City, Mich., and its successor, Industrial Brownhoist Corporation, Cleveland, Ohio, has opened an office at 1600 Arch street, Philadelphia, Pa., to act as special agent for the sale of railroad specialties and cranes.

HOWARD G. GASS, vice-president of the St. Louis Car Company, has been elected a director to succeed George W. Scruggs, who has resigned as secretary and treasurer. Louis F. Gempp, assistant treasurer, has been promoted to the position of treasurer and Edward J. Plowden, assistant secretary, has been promoted to secretary. John F. Tringle has been appointed assistant treasurer.

HERBERT A. MAY, who is identified with a number of local manufacturing concerns and banks in the Pittsburgh, Pa., district, has been appointed assistant to the president of the Westinghouse Electric & Manufacturing Company. Mr. May will have his headquarters in the Grant building, Pittsburgh, where the offices of the Westinghouse central sales district are located.

JESSE V. HONEYCUTT, who has been sales agent in New York City for frogs, switches and railroad material, has been appointed manager of sales of frogs and switches, of the Bethlehem Steel Company, with office at Bethlehem, Pa. He succeeds to the place of Neil E. Salsich, who has resigned to become vice-president in charge of sales of the Jeffrey Manufacturing Company, Columbus, Ohio.

W. A. MCCALLUM has resigned as president and managing director of the Economy Railway Appliance Company, Ltd., and has been appointed president and managing director of the Reliance Railway Appliance Company, Ltd., 712 Railway Exchange building, Montreal, Canada. This company has the sole manufacturing and selling rights in Canada and the United States for the Economy tender water level indicator.

AUGUSTUS WOOD, formerly chief engineer and works manager of the Niles Tool works, Hamilton, Ohio, has returned to its service in the capacity of consulting engineer. During his absence from Hamilton, he has held the positions of works manager at the Putnam Machine Company, Fitchburg, Mass., and consulting engineer for the parent company, Manning, Maxwell & Moore. More recently he has been connected as consulting engineer with the Consolidated Machine Tool Corporation, Rochester. N. Y.

PORTER HURD, Packard building, Philadelphia, Pa., has been appointed representative of the Illinois Testing Laboratories, Inc., Chicago. Mr. Hurd's territory includes eastern Pennsylvania, southern New Jersey, Delaware and Maryland. Ernest H. Du Vivier, 30 Church street, New York, represents the Laboratories in Metropolitan New York and northern New Jersey, and F. W. Fernald, 335 Fifth avenue, Pittsburgh, Pa., is in charge of the territory comprising western Pennsylvania and West Virginia.

J. A. MILLER, general manager of sales of the Vanadium Corporation of America, has been appointed assistant to president, Pittsburgh district, with headquarters at Pittsburgh Pa. Gustav Laub, assistant general manager of sales, succeeds Mr. Miller as general manager of sales. Mr. Laub's headquarters are at New York.

CLAUS GREVE, president of the Cleveland Pneumatic Tool Company, Cleveland, Ohio, has been elected chairman of the board; L. W. Greve, treasurer, has been elected president, and John DeMooy has been elected treasurer. L. W. Greve is also president of its associated companies, the Champion Machine & Forging Company and the Cleveland Rock Drill Company. H. W. Foster, vice-president, H. S. Covey, secretary, and Arthur Scott, superintendent of the Cleveland Pneumatic Tool Company, were re-elected and A. F. Barner was appointed assistant secretary.

R. C. VILAS, who has been associated with the Pyle-National Company, Chicago, since its incorporation in January, 1899, and who has been president since 1908, has been elected chairman of the board and has been succeeded by L. H. Vilas, his brother. William Miller, vice-president, has been elected senior vice-president, and J. A. Amos, vice-president, has been elected vice-president and general manager. Crawford P. McGinnis has been appointed district sales manager of the Pacific Coast territory of the Pyle-National Company, with headquarters in the Hobart building, San Francisco, Cal.

H. C. BEAVER, formerly executive vice-president of the Rolls-Royce of America, has been appointed a vice-president of the Worthington Pump & Machinery Corporation, New York, and E. E. Yake has been appointed a vice-president. Mr. Beaver, who has been identified with the engineering, manufacture and sale of mechanical and electrical equipment for more than 30 years, will devote his time principally to the administration of the sales department of the Worthington Corporation. Mr. Yake will continue to direct the manufacturing and engineering divisions which were assigned to him in April, 1927.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has formed a railway engineering department at Pittsburgh, Pa., by grouping its railway equipment and railway motor engineering departments, its railway engineering division of its general engineering department, its traction and mining division of its control engineering department, its overhead line material section of its supply engineering department, and its trolley design section of its gearing engineering department. Frederick Urban, assistant to the vice-president, has been placed in charge of the new department, and Francis E. Wynne, manager of the railway equipment engineering department, has been appointed assistant general manager. Claude Bethel, manager of the railway motor engineering division, has been appointed division engineer in charge of the equipment and control division; Sidney B. Cooper, manager of engineering in the general engineering department, has been appointed division engineer in charge of the project and motor division, Lynn G. Riley, assistant to the manager of the control engineering department, has been made assistant division engineer on control, and Lloyd J. Hibbard, special engineer in general sales, has been appointed special engineer.

LE SAUVAGE & BEARDSLEY, Genesee building, Buffalo, N. Y., have been appointed direct representatives for Lo-Hed monorail electric hoists in the districts of Buffalo and Rochester by the manufacturers, the American Engineering Company, Philadelphia, Pa. Weed & Company will continue to distribute Lo-Heds in Buffalo and Rochester, co-operating with Le Sauvage & Beardsley.

R. B. MCCOLL, who has been elected president and a director of the McIntosh & Seymour Corporation, Auburn, N. Y., as announced in the February issue of the *Railway Mechanical Engineer*, was born in 1882 at Kilmarnock, Scotland, where he attended the Kilmarnock Academy and the Science and Art College. After serving a special apprenticeship and working in various departments of the Glasgow & South-western, Mr. McColl was employed by Robert Stephenson & Sons, locomotive builders, Darlington, England, as a draftsman. In 1905 he went to the Montreal Locomotive Works, Montreal, Canada,

R. B. McColl

and served in several departments until he became assistant superintendent, then superintendent of works and finally works manager. In 1917 he was appointed manager of the munition department of the Eddystone Munition Company, where he served until after the armistice. Returning to England he was appointed general manager of the Armstrong-Whitworth

(Continued on next left-hand page)

Company's locomotive department in charge of the building and equipping of the locomotive works and of the sales, engineering and manufacturing of locomotives. Later, in addition, he was made general manager of the pneumatic tool department, gas and oil engine department and director of the Works board of all the company's plants which included shipbuilding and the construction of Diesel oil engines for marine work, etc. In January, 1922, Mr. McColl became attached to the New York office of the American Locomotive Company and the following June was appointed assistant manager of the Schenectady plant. In January, 1925, he was appointed manager of the plant, which position he held at the time of his election as president of the McIntosh & Seymour Corporation.

John S. Stevenson, who has been appointed manager of the Dunkirk (N. Y.) plant of the American Locomotive Company, began work in 1891 as an apprentice in the shops of the Peninsular Car Company. He first served for five years in the templet shops and then for four years learning car building. Mr. Stevenson was then transferred to the engineering department of a new company formed by the consolidation of the Peninsular Car Company with the Michigan Car Company. In 1899 this company became a part of the American Car & Foundry Company and in 1901 he was transferred to the St. Louis mechanical department. He returned in 1902 to the Peninsular plant in the shop engineering department, which position he held until the latter part of the same year when he became employed by the Russell Wheel & Foundry Company in charge of its car work. Mr. Stevenson returned to the service of the American Car & Foundry Company in 1912 and was in entire charge of the shop engineering of the Detroit plant until the close of the war when he was appointed general superintendent of the same plant. In 1926, he was transferred to the New York office and until his appointment as manager of the Dunkirk plant of the American Locomotive Company, had been in charge of the general development work of the entire company.

R. P. Allison, who has been appointed manager of the Schenectady (N. Y.) plant of the American Locomotive Company, entered the service of that company as an apprentice in 1896. He subsequently served as journeyman, assistant foreman and foreman until 1904 when he was appointed machine shop foreman of the Montreal Locomotive Works, Montreal, Canada, retaining that position until 1908 when he was appointed plant engineer. In 1916, Mr. Allison entered the employ of the Poole Engineering Company, Baltimore, Md., as works manager, serving in that position until 1919, and then was appointed works manager for Hale & Kilbourne, Philadelphia, Pa. Two years later Mr. Allison was appointed general superintendent of the Richmond plant of the American Locomotive Company and in 1927 was promoted to manager of the same plant. In April, 1930, he was transferred as manager to the Dunkirk plant of the American Locomotive Company.

Obituary

Orton Lee Prime, president of the Prime Manufacturing Company, Milwaukee, Wis., who died at Rochester, Minn., on January 14, was born on April 3, 1874, at Fall River, Wis. Mr. Prime attended St. John's Military Academy at Delafield, Wis., and Michigan University, at Ann Harbor, Mich. He served in the Spanish American War as a corporal in the second regiment Troop B, United States Cavalry. Early in 1900 Mr. Prime was president of the Prime Steel Company, Milwaukee, and in 1914 when the Prime Manufacturing Company was formed Mr. Prime continued as president.

Orton Lee Prime

Henry Giessel, president of the Henry Giessel Company, Chicago, died in Park Ridge, Ill., on January 27. Mr. Giessel was born on July 31, 1855 in Germany and came to the United States at the age of 12. After completing his education and serving his apprenticeship in the sheet metal trade he began the manufacture of various metal specialties, including acetylene gas machines. During 1892 he began the manufacture of water filters for use on railroad dining cars and in 1914 formed and became president of the Henry Giessel Company to manufacture sanitary drinking water coolers, filters and auxiliary appliances for use on all types of railroad passenger equipment.

W. H. Sauvage, vice-president of the Royal Railway Supply Company and president of the Sauvage Appliance Company, was shot and killed in his office at 90 West street, New York City, on February 5. According to the medical examiner's report on the case, Mr. Sauvage was shot by Andrew Lenahan, office manager of the same company, who was fatally wounded in his subsequent attempt at suicide. Mr. Lenahan died on his way to the hospital. Mr. Sauvage was well known in the railway supply business. He was born in February, 1872, at Pomeroy, Ohio, and was an engineer and an inventor of railway appliances. He had served as first sergeant from 1889 to 1892 in the Colorado National Guard. The greater part of Mr. Sauvage's business life had been connected with his own companies. He was the author of articles on power and hand brakes in technical papers and magazines.

Personal Mention

General

H. W. Reinhardt, master mechanic of the Missouri Pacific at North Little Rock, Ark., has been appointed assistant superintendent of motive power of the Chicago Great Western.

E. A. Shull, master mechanic of the Wichita Falls & Southern, has been appointed superintendent of motive power, with headquarters as before at Wichita Falls, Tex.

Master Mechanics and Road Foremen

E. R. Hanna has been appointed master mechanic of the Arkansas division of the Missouri Pacific, with headquarters at North Little Rock, Ark.

A. E. Bruning, road foreman of engines of the Chicago & Illinois Midland, has been appointed assistant master mechanic, with headquarters at Springfield, Ill.

H. M. Allan has been appointed district master mechanic of the British Columbia district of the Canadian Pacific, with headquarters at Vancouver, B. C.

G. T. Callender has been appointed master mechanic of the Central Kansas and Wichita divisions of the Missouri Pacific, with headquarters at Osawatomie, Kan.

C. T. Hunt, assistant master mechanic of the Pennsylvania at Wilmington, Del., has been transferred to the Pittsburgh division, with headquarters at Conemaugh, Pa.

George Schepp has been appointed master mechanic of the Joplin and White River divisions of the Missouri Pacific, with headquarters at Nevada, Mo.

J. S. Richards, master mechanic of the Pennsylvania at Mahoningtown (New Castle), Pa., has been transferred to the Buffalo division, with headquarters at Olean, N. Y.

W. R. Sorel, locomotive foreman of the Canadian Pacific at Calgary, Alta., has been promoted to the position of master mechanic of the Calgary division at the same point, succeeding H. M. Allan.

P. S. Lindsay, assistant superintendent of the Nelson division of the Canadian Pacific, has been appointed master mechanic of the Kootenay division, with headquarters as before at Nelson, B. C.

G. A. Rhoades, general foreman of the Buffalo division of the Pennsylvania at Oil City, Pa., has been appointed assistant master mechanic of the Akron division, with headquarters at Akron, Ohio.

W. O. Teufel, assistant master mechanic of the Pennsylvania at Altoona, Pa., has been appointed master mechanic of the Erie & Ashtabula division, with headquarters at Mohoningtown (New Castle), Pa.

(Continued on next left-hand page)

A. V. Birch, master mechanic of the Chicago Terminal division of the Minneapolis, St. Paul & Sault Ste. Marie, with headquarters at Schiller Park, Ill., has retired from active duty after 43 years of service on the Wisconsin Central and its successor, the Soo Line.

Car Department

Percy O. Hews has been appointed general car foreman of the Bangor & Aroostook, with headquarters at Bangor, Me.

Victor Manan has been appointed master painter at the Waycross, Ga., shops of the Atlantic Coast Line. Mr. Manan was previously assistant paint shop foreman.

Purchasing and Stores

H. V. Garza has been appointed purchasing agent of the National Railways of Mexico, with headquarters in Mexico, D. F.

William F. Niehaus has been appointed assistant to the purchasing agent of the Missouri-Kansas-Texas, with headquarters at St. Louis, Mo.

H. W. Hughes, chief clerk in the purchasing department of the Gulf, Colorado & Santa Fe at Clebourne, has been promoted to the position of division storekeeper with headquarters at Temple, Tex., succeeding C. J. Irwin.

F. E. Cragin, general storekeeper of the Los Angeles & Salt Lake, has been appointed district storekeeper with headquarters as before at Los Angeles, Cal. The position of general storekeeper at Los Angeles has been abolished.

Obituary

Joseph R. Haynes, purchasing agent of the Chicago, Burlington & Quincy, at Chicago, died on February 20.

Robert L. Dillon, district storekeeper on the Missouri-Kansas-Texas at Sedalia, Mo., until his retirement in 1929, died recently at Denison, Tex.

Harry C. Stevens, general storekeeper of the Wabash and the Ann Arbor, died at Toledo, Ohio, on January 12. Mr. Stevens had been engaged in railway storekeeping service for 25 years.

George F. Stevens, assistant engineer of the Boston & Maine, with headquarters at the Billerica (Mass.) shops, died suddenly at his home at Kingston, N. H., on January 30. Mr. Stevens was born on January 17, 1873, at Haverhill, Mass., and received his education at the local public schools. He commenced his railroad service with the B. & M. on November 18, 1895, as an apprentice draftsman in the motive power department. Between the period 1901 to 1903 he served as assistant to the master mechanic at the Boston shops and in the latter year became assistant to chief draftsman at Boston. In 1916, he was promoted to chief draftsman and in 1923 he became office engineer in the mechanical engineer's office. In 1927 he was advanced to the position of assistant engineer.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

Turbines.—Complete data on the application and operation of turbines are contained in the latest bulletin of the Coppus Engineering Corporation, 344 Park avenue, Worcester, Mass. How to select the proper unit for each specific duty is also discussed.

Pipe Bending.—The A. M. Byers Company, Clark building, Pittsburgh, Pa., in a bulletin, No. 50, setting forth the principles and practice of bending Byers Genuine wrought iron pipe, presents an interesting discussion of what happens in the pipe during the bending operation, hot or cold, and how successful results may be obtained.

Metal Working Tools and Machinery.—A unique catalog of 158 pages of a convenient size for reference purposes has been issued by Joseph T. Ryerson & Son, Inc., Sixteenth and Rockwell streets, Chicago. Practically every type of tool and portable machinery for manufacturers, job shops and contractors in the metal working field is included in the catalogue, all supplies being omitted.

Lukenweld Construction.—Lukenweld construction, a fabricated product for manufacturing units, such as housings, bases, beds, gear cases and other parts of machinery and equipment, is described in a bulletin issued by Lukenweld, Inc., a division of the Lukens Steel Company, Coatesville, Pa. By this method plates or slabs of Lukens Welding Quality rolled steel are gas cut to shape, formed if necessary, and then arc welded into the complete unit.

Lathes.—1930 new model Precision lathes for use in manufacturing plants, tool rooms, general repair shops, machine shops, etc., are illustrated and described in Hand Book No. 44 issued by the South Bend Lathe Works, 421 E. Madison street, South Bend, Ind.

Electroplating Aluminum.—"Electroplating Aluminum" is the title of a 36-page booklet issued by the Aluminum Company of America, Pittsburgh, Pa., describing the steps necessary for the cleaning and plating of aluminum both on smooth and roughened surfaces. Diagrams summarize the various procedures discussed.

Stewart Melting Pot.—"The Stewart Melting Pot" is a 30-page catalog covering annealing, normalizing, hardening of carbon and high-speed steels, carburizing, cyanide hardening, lead hardening, tool dressing, tempering and quenching. It has been issued by the Chicago Flexible Shaft Company, Chicago, for the man in the hardening room and for those interested in the heat treatment of metals.

Oil-Electric Locomotives and Rail-Cars.—Special Publication 1880, a recent 60-page illustrated publication of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., contains a description of the applications, operation and construction of old-electric traction apparatus and photographs and diagrams of numerous locomotives and cars, many of which are now in service. It is composed of five sections—A general description of oil-electric locomotives and rail cars, selection of equipment, a general description of oil-electric-power plant, oil-electric rail car data, and oil-electric locomotive data. Comparative cost of operation figures are given, and curves showing certain length runs for certain grades are used to illustrate short-cut methods for picking out the right locomotive for the right application.

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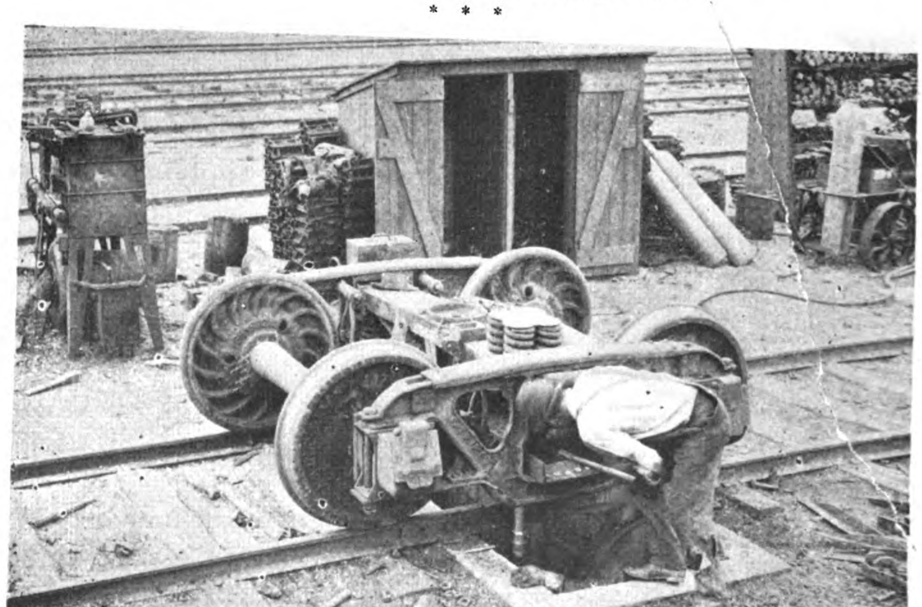

A transverse concrete pit under the truck repair track facilitates driving rivets and doing other work underneath

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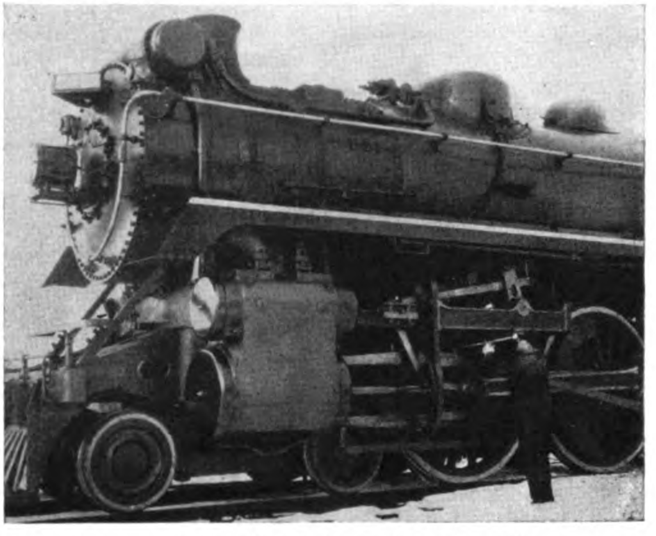
4-6-4 Type Locomotives on the Canadian Pacific

The Canadian Pacific has had ten 4-6-4 type locomotives in fast passenger service some of which have already made 140,000 miles—Experience with these locomotives resulted in an order for ten more of the same design — Low maintenance costs and economical performance have featured the operation of this power



Front-end view of the Canadian Pacific 4-6-4 type locomotive showing the valve-gear arrangement

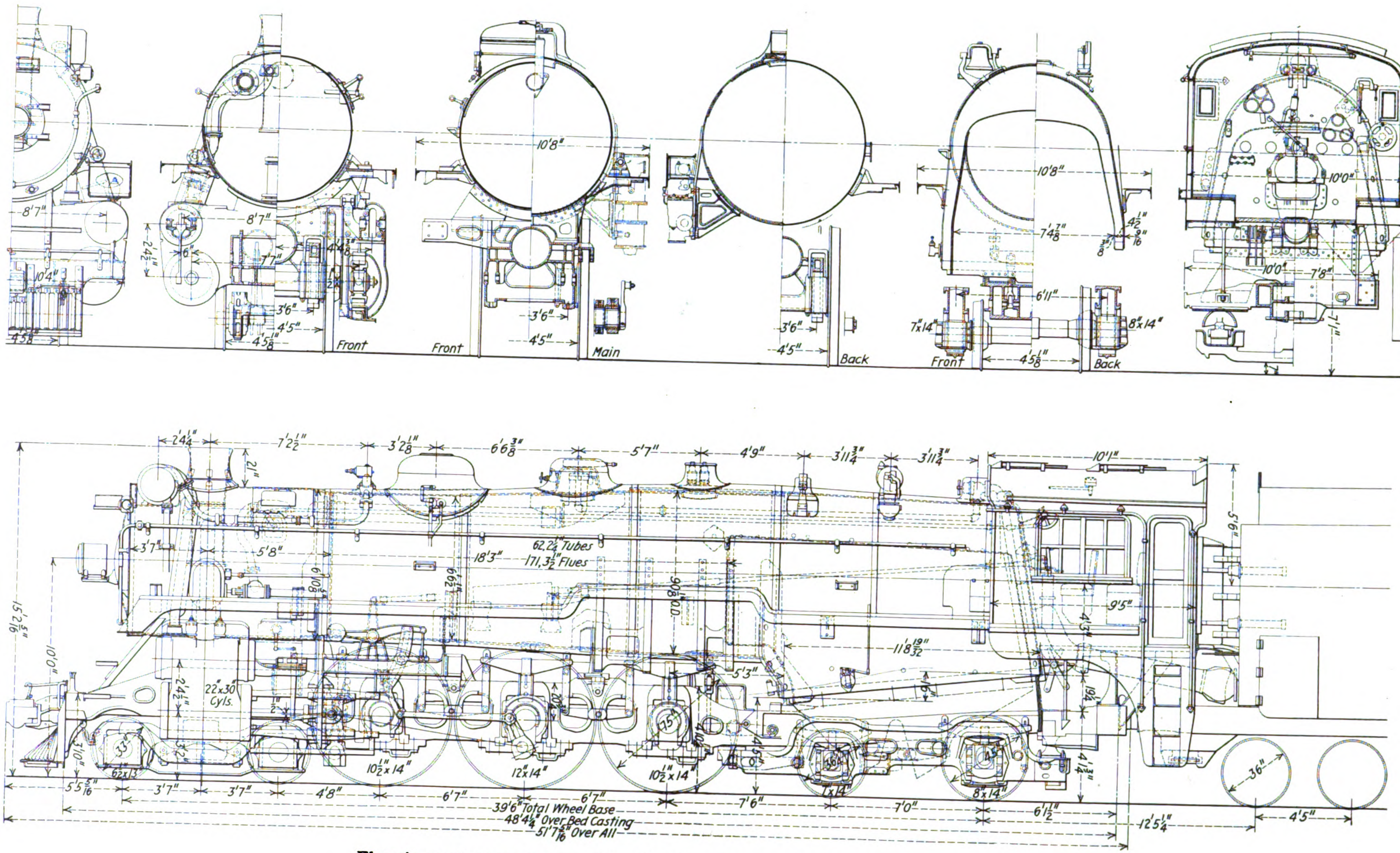
TWENTY 4-6-4 type locomotives, built by the Montreal Locomotive Works, Ltd., have been operating in fast-passenger service on the Canadian Pacific which have more than met the expectations of the designers not only with respect to maintenance and economical performance, but also from the standpoint of speed and smooth riding qualities. Ten of these locomotives, known as class Hla, have been in service since November, 1929. The second ten, class Hlb, were delivered during the last two months of 1930 and January, 1931. All 20 locomotives were built to designs furnished by the mechanical-engineering department of the railroad.

The class Hl locomotives develop a tractive force of 45,250 lb. The cylinders are of small diameter, 22 in. by 30 in. stroke and the driving wheels have a diameter of 75 in. The total weight is 350,900 lb. of which 185,000 lb. is carried as the drivers. The factor of adhesion is 4.08. The boilers operate at a pressure of 275 lb. They have an evaporative heating surface of 3,861 sq. ft. The firebox is 88⅞ in. wide by 131-1/16 long, and the grates have an area of 80.8 sq. ft. There is practically no difference with respect to important dimensions, weights and proportions between the class Hla (No. 2800 to No. 2809, inclusive) and the class Hlb (No. 2810 to No. 2819, inclusive), except for a slight increase in weight on the drivers of the latter. The Hla class carries 183,900 lb. on the drivers, as compared with 185,000 lb. for the Hlb class.

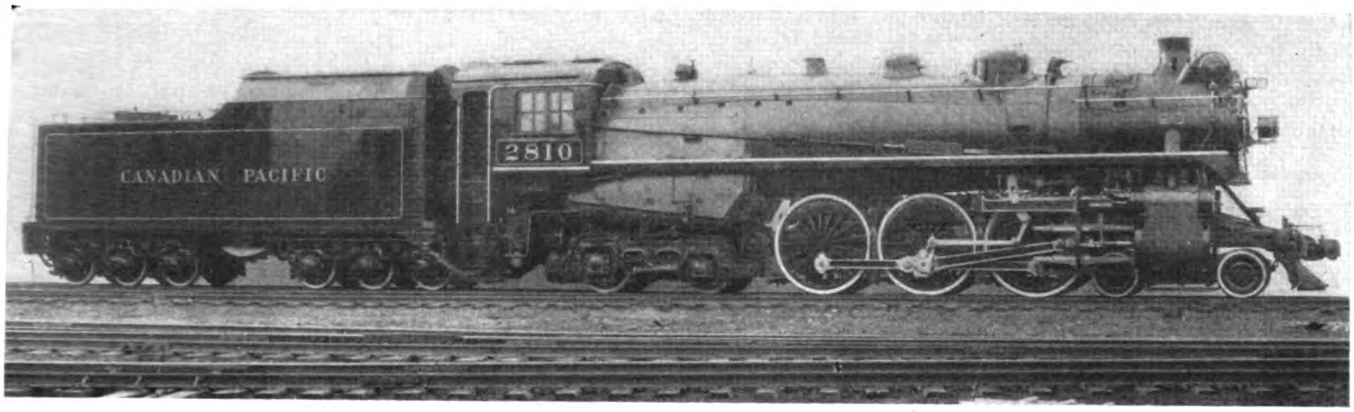
Broken In on Montreal-Chicago Passenger Runs

The locomotives were first broken in between Montreal, Que., and Smiths Falls, Ont., and then placed in extended-run through-passenger service on such trains as the "Chicago Express," "The Canadian" and the "Royal York." At the present time, these locomotives are operating on the Eastern and Western Lines on extended runs varying from 340 to 350 miles. These 4-6-4 locomotives replaced 4-6-2 type locomotives, class G-3, which were described in the December, 1923, *Railway Mechanical Engineer*, page 803.

It was not long after the 4-6-4 type locomotives were placed in service that it was found that the schedule time of passenger trains could be reduced, as was contemplated when the locomotives were ordered. These



Elevation and cross-sections of the Canadian Pacific 4-6-4 type locomotives class H1



Canadian Pacific 4-6-4 type locomotive built by the Montreal Locomotive Works, Ltd.

locomotives are capable of handling trains at extremely high maximum speeds and have demonstrated their ability to travel at average speeds of from 90 to 95 miles per hour.

A number of trial runs were made between Montreal and Smiths Falls on the Winchester subdivision, a distance of 128.7 miles. This subdivision is rolling profile with a maximum of .4 per cent grade. These runs were made with locomotive No. 2800 after it had been in service over 80,000 miles, tests being conducted without any repairs being made to the locomotive. With a 12-car train, an average of 1,021 tons behind the tender, the locomotive consumed 12,000 lb. of coal and 7,000 Imperial gal. (8,400 U. S. gal.) of water. The average coal consumption, east and westbound, was 90 lb. per 1,000 ton miles and 90 lb. per locomotive mile. The average steam pressure carried during the round trip was 258 lb. per sq. in. The average feedwater temperature was 218 deg. F. and the average superheat temperature, 625 deg. F.

Table of Dimensions, Weights and Proportions of the Canadian Pacific 4-6-4 Type Locomotives

Railroad	Canadian Pacific
Builders	Montreal Locomotive Works, Ltd.
Type of locomotive	4-6-4
Railroad class	H-1
Service	Passenger
Cylinders, diameter and stroke	22 in. by 30 in.
Valve gear, type	Walschaert
Valves, piston type, size	14 in.
Maximum travel	7 in.
Steam lap	1⅛ in.
Exhaust clearance	¼ in.
Lead in full gear	¼ in.
Weights in working order:	
On drivers	185,000 lb.
On front truck	62,800 lb.
On trailing truck	103,000 lb.
Total engine	350,900 lb.
Tender	292,000 lb.
Total engine and tender	642,900 lb.
Wheel bases:	
Driving	13 ft. 2 in.
Total engine	39 ft. 6 in.
Total engine and tender	80 ft. 6¼ in.
Wheels diameter outside tires:	
Driving	75 in.
Front truck	33 in.
Trailing truck, front	36¼ in.
Trailing truck, rear	45 in.
Journals, diameter and length:	
Driving, main	12 in. by 14 in.
Driving, others	10½ in. by 14 in.
Front truck	6½ in. by 13 in.
Trailing truck, front	7 in. by 14 in.
Trailing truck, rear	8 in. by 14 in.
Boiler:	
Type	Conical
Steam pressure	275 lb.
Fuel, kind	Soft coal
Diameter, front ring, outside	80⅛ in.
Firebox, length and width	131 1/16 in. by 88⅞ in.
Tubes, number and diameter	62—2¼ in.
Flues, number and diameter	171—3½ in.
Length over tube sheets	18 ft. 3 in.
Grate area	80.8 sq. ft.
Heating surfaces:	
Firebox and combustion chamber	313.5 sq. ft.
Arch tubes	38.5 sq. ft.
Tubes and flues	3,509 sq. ft.
Total evaporative	3,861 sq. ft.
Superheating surface	1,640 sq. ft.
Combined evaporative and superheat	5,501 sq. ft.
Tender:	
Style	Rectangular
Water capacity	12,000 Imperial gal. (14,400 U. S. gal.)
Fuel capacity	21 tons.
Wheels, diameter outside tires	36¼ in.
Maximum rated tractive force	45,250 lb.
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent	52.7
Weight on drivers ÷ tractive force	4.08
Total weight engine ÷ comb. heating surface	63.7
Boiler proportions:	
Tractive force ÷ comb. heating surface	8.21
Tractive force × dia. drivers ÷ comb. heating surface	616
Firebox heat. surface ÷ grate area	4.36
Firebox heat. surface, per cent of evap. heat. surface	9.12
Superheat. surface, per cent of evap. heat. surface	42.4

With a 15-car train, averaging 1,281 tons behind the tender, east and westbound over the same division, the locomotive used 14,200 lb. of coal or 90 lb. per 1,000 ton miles and 112 lb. per locomotive mile. An average steam pressure of 266 lb. was carried; the average feedwater temperature was 214 deg. F. and the average superheat temperature, 650 deg. F. A total of 7,500 Imperial gal. (9,000 U. S. gal.) of water was used.

The same locomotive, hauling a 19-car train averaging 1,652 tons behind the tender, used 15,500 lb. of coal for the round trip, or 70 lb. per 1,000 ton miles and 118 lb. per locomotive mile, and 8,500 Imperial gal. (10,200 U. S. gal) of water. The average steam pressure carried was 274 lb.; average feedwater temperature, 222 deg. F. and average superheat temperature, 675 deg. F.

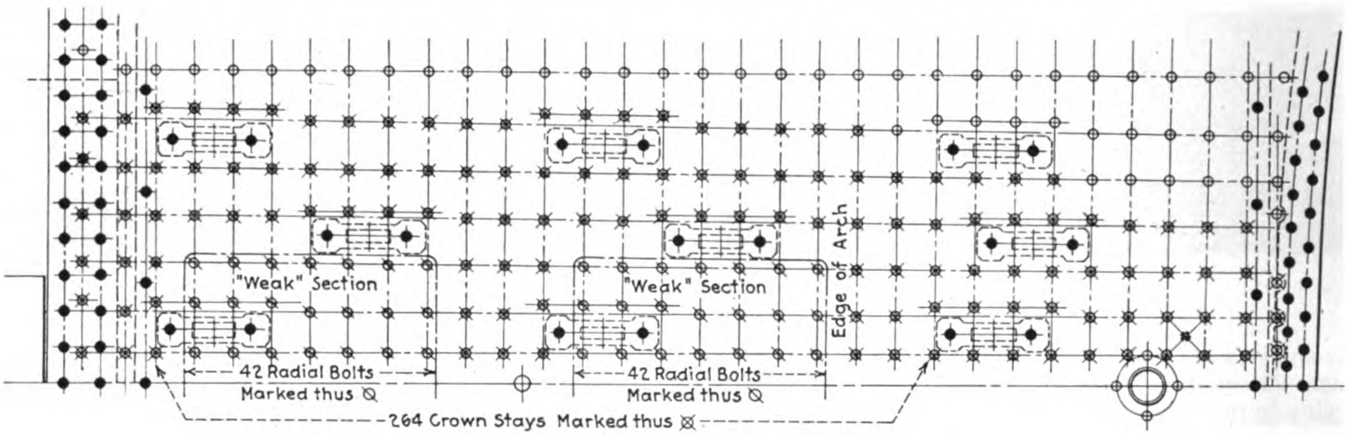
During these trial runs which began with a 12-car train of 1,021 tons, the tonnage was increased by adding one car for successive runs until the two last runs were made with 19 cars, averaging 1,652 tons. The steam pressure carried was stepped up gradually from 258 lb. with each increase in tonnage. At the same time the coal used per 1,000 ton miles gradually decreased from 90 lb. to 70 lb. The water consumption gradually increased from 6,800 Imperial gal. to 8,500 Imperial gal. The practice of varying steam pressure with train weight has proved to be economical with respect to fuel and steam consumption. It has also reduced the excessive opening of safety valves, especially on arrival at stations.

First Ten Locomotives Have Made 140,000 Miles

The first locomotives delivered have made a mileage of nearly 140,000 miles. Practically no maintenance, except the usual engine-terminal attention, has been required up to the present time. The wear on rod bushings has necessitated renewal every 50,000 to 60,000 miles. Service to date would indicate that main driving boxes require reboring after 110,000 miles service. Aside from the two items mentioned, no repairs to running gear, boiler or appliances have been required.

These locomotives were designed primarily for economical operation and maintenance and to meet the sustained speeds required in through-passenger service.

These locomotives have exceptionally smooth and easy riding qualities, insuring comfort for the crews even at maximum speeds. The cabs are of the railroad's standard vestibule type, entirely enclosed, which affords comfortable conditions in severe weather. The customary opening to the tender shoveling deck is enclosed by hinged doors, which is possible with the type BK stoker as practically no access is required to the tender coal space at any time. The cabs are illuminated at night by a single electric bulb placed in a sheet metal case attached to the roof of the cab immediately in front of the back cab wall. Two holes punched in the front side of the shade throw beams of light on the two groups of three gages located on the fireman's and engineman's side of the boiler head, respectively. The water glass is illuminated by a separate bulb contained in the cast aluminum water glass guard, the light being emitted through a saw slot directly on the tubular water glass. Additional lights, provided with socket switches, are placed on the wall of the cab directly behind the fireman's and engineman's seats for the reading of orders.

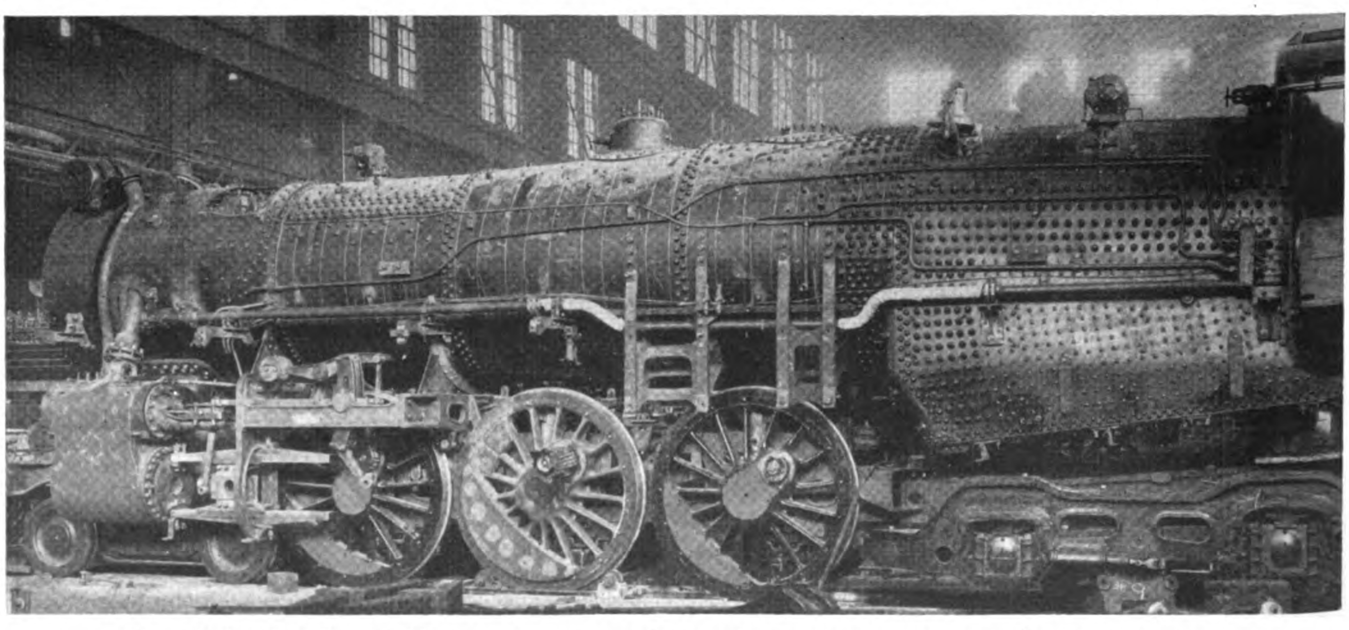


Section of crown sheet showing the "weak sections"

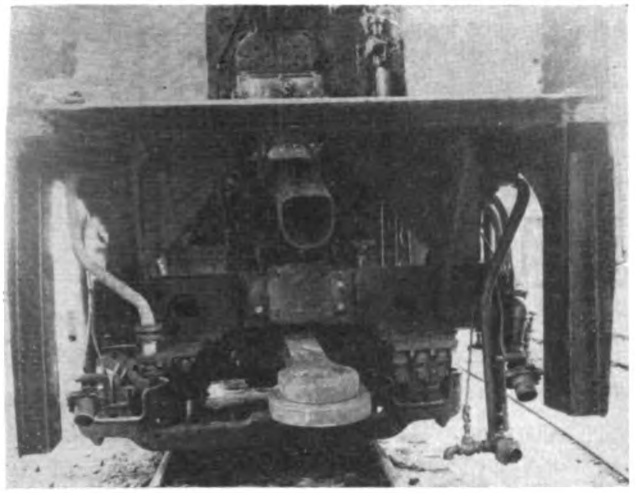
The Boiler

It will be observed from the illustration showing the interior view of the cab that the gages and valve handles are conveniently located for ease of access and operation. The cabs are roomy and comfortable, and are provided with three seats, two on the fireman's side and one on the engineman's side of the cab.

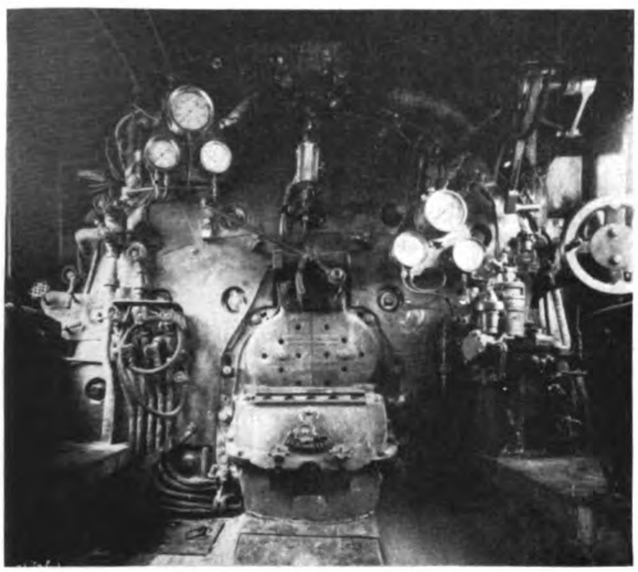
The locomotives are of conventional form, but close attention has been given to details, not only to secure efficient performance but economical maintenance. The boiler and fireboxes are of nickel-steel construction. The crown sheet of the firebox on the last ten locomotives, owing to the strength of the nickel-steel plates, is applied with two "weak sections," which are designed to fail before any other portion of the firebox fails in case of low water in the boiler. This safety feature, illustrated in one of the drawings, tends to localize the danger should there develop a condition in the boiler which might cause a serious explosion. The "weak sections" are supported by parallel threaded staybolts and are surrounded by a zone of staybolts having tapered threads, extending from the front to the back of the crown sheet. All staybolts are of two per cent nickel-steel. The tubes and flues are electrically welded, with a special low-carbon wire (not fluxed), around the outside of the bead at the back tube sheet. This has been standard practice on the Canadian Pacific for the past nine years. The railroad has been getting an average of 130,000 miles flue service and has had little trouble with leaky flues. Tubes and flues are removed during general repairs, every 18 months to two years. No external leaks in the barrel of the boiler have been encountered



One of the Canadian Pacific 4-6-4 type locomotives under construction in the shops of the builders



Front end of tender showing the engine connections



Interior of the cab showing the back-head arrangement

thus far during the one year's operation of the first ten locomotives.

The grates are of the Rosebud or pin-hole type with an air opening of about 14 per cent. Two baffle or deflector walls have been applied underneath the mud ring, between the underside of the grates and above the ash pan, which extend the entire length of the grates. These baffles, which are not shown on the drawings, deflect the air as it enters the side of the ash pan downward and then up through the center of the grate area. In addition, the arch tubes are spaced to provide a wide arch-brick span through the center of the firebox and narrow span at the sides. The deep center arch causes the gasses to flow toward the center of the firebox and away from the side sheets.

The combination of baffle walls and arrangement of arch brick prevents the cool air from circulating along the side sheets and, because of the more uniform temperature, practically eliminating warping and cracking of the sheets and leakage of staybolts. As to be expected, with such an arrangement of baffle walls and arch brick, the fuel burns more rapidly at the center of the grates than around the sides. This is an ideal condition. The arch tubes are secured at the throat sheet and in the back head in arch-tube sleeves, which gives a rigid stayed anchorage for the tube ends and permits expansion and contraction of the arch tubes without injury to either the tubes or sheets. In addition, the firemen are instructed not to allow the fire to die down when drifting or standing so as not to subject the firebox sheets to a wide range of temperatures.

Type E superheaters are applied which provide a superheating surface of 1,640 sq. ft. Other special

List of Special Appliances and Equipment Applied on the Canadian Pacific 4-6-4 Type Locomotives

Railroad	Canadian Pacific
Builder	Montreal Locomotive Works, Ltd.
Service	Passenger
Boiler and Firebox:	
Blow-off cocks	Murphy
Feedwater heater	Elesco
Firebrick arch	Canada Firebrick Co. (Security)
Firebox steel	Nickel steel (C. P. R. Spec. No. 121)
Fire door	Franklin No. 8-A special
Grate shakers	C. P. R., hand-operated
Injector	Hancock
Injector check	McAvity
Jacket iron	Princess planished steel
Line checks	McAvity
Safety valves	World, Consolidated
Smokebox connection	Flextite
Staybolts, flexible	Tate or Alco
Staybolt steel	Nickel, two per cent
Stoker	Standard Type BK
Superheater	Type E
Throttle	American
Turrets, steam	McAvity
Unions (pipe)	Dart
Cylinders and Running Gear:	
Boxes—main	Grisco
Cylinder cocks	Hancock, air operated
Cylinder exhaust-passage drain	Hancock automatic
Cylinders, integral with frame	Commonwealth
Driving-box spreader castings	Franklin
Engine and tender bearings	S.K.F. (Trailing truck one loco.)
Journal bearings and brass castings	Canadian Bronze, Ltd.
Packing, (Piston rod, valve steam, air compressor, feed pump)	King
Packing, other	Garlock, Anchor, or Kearsage
Radial buffers	Franklin
Reverse gear	Screw
Truck, engine	Commonwealth
Truck trailing	Commonwealth
Tires, locomotive and tender	Peech & Tozer steel
Valve crosshead guide	Cole (Self centering)
Valves—high pressure	McAvity
Valves—low pressure	Glove (World brand)
Cab and Miscellaneous:	
Air brake, engine and tender	No. 6 Schedule E. T.
Bell ringer	Taynold, type B
Car replacers	Holco, type C
Classification lamps	C. P. R. standard
Couplings, flexible	Barco
Driving box lubricators	Franklin automatic grease
Electric headlight	Pyle National, 14 in.
Gage, cut-off control	McAvity
Headlight generator	Pyle National, type E-2
Lubricators	Nathan, B-feed
Steam gages	Star, Morrison or Crosby
Steamheat and signal gages	Star, Crosby or Morrison
Triangular number lamp	Robt. Mitchell Co.
Uncoupling device	Canadian Appliance Co., Ltd.
Water-gage glasses	Moncrieff Unific
Whistle	C. P. R. standard
Tender:	
Brake	International Equipment Co.
Draft gear	Miner A-5-X-B
Emergency light	Piper
Journal boxes	McCord
Tank hose couplings	Improved Gravity
Steamheat couplings	Gold
Underframe	Commonwealth

equipment includes an Elesco feedwater heater and a type CF boiler-feed pump.

The steam turret from which the steam pipes lead to the air compressor, feedwater heater, blower, generator, stoker, etc., is located on the left side of the boiler immediately ahead of the cab. The operating valves lead to a bracket directly in front of the fireman's seat. The size of the piping for the steam turret to the auxiliaries has been reduced from what has been customary practice. The customary $1\frac{1}{4}$-in. steam-supply pipe to the air compressor is reduced to $\frac{3}{4}$-in. The feedwater heater pump steam supply is furnished through a $\frac{15}{16}$-in. opening. The other auxiliaries are supplied steam as follows: Through a 17-in pipe to the blower and whistle; $\frac{1}{2}$-in. pipe to the turbo generator; $1\frac{1}{4}$-in. for the stoker engine and jets with a 1-in. line from the control manifold to

(Concluded on page 185)

Layouts of Locomotives On Curves*

By R. F. Hall

A presentation of the factors involved in laying out locomotives on curved track to determine if their wheel base arrangement will permit them to pass around a curve of a given radius—The errors involved in making various types of layouts are discussed by the author—Part I

LAYOUTS of locomotives on curved track are frequently required for the purpose of determining whether their wheel base arrangement will allow them to pass around a curve of a given radius, to show the relation of relatively movable parts to each other, or the relation of the locomotive to others on the same or adjacent tracks.

In making these layouts various methods are in use which employ, in a greater or less degree, certain simplifying factors, either to reduce the labor of computation or to limit the layout to a convenient size. While these approximations generally involve errors which are negligible, particularly in view of the variations in the actual construction, they may, under some conditions, lead to serious error. It is the purpose of this article to show how the extent of the error may be determined and controlled.

The simplest layout method is that in which the radius of the curve and the locomotive dimensions are all drawn to the same scale, on what is known as an equal-scale diagram. In choosing the scale used with this diagram, two conflicting requirements are met: To insure accuracy of the locomotive dimensions and of the clearances especially, a fairly large scale is desirable, while if the layout is to be kept to a convenient size, or if the curve is to be drawn directly by being struck from a center, a smaller scale is preferable. A scale of 1½ in. to the foot is commonly used and this will ordinarily make it necessary to lay out the curve by means of ordinates, as shown in Fig. 1, either

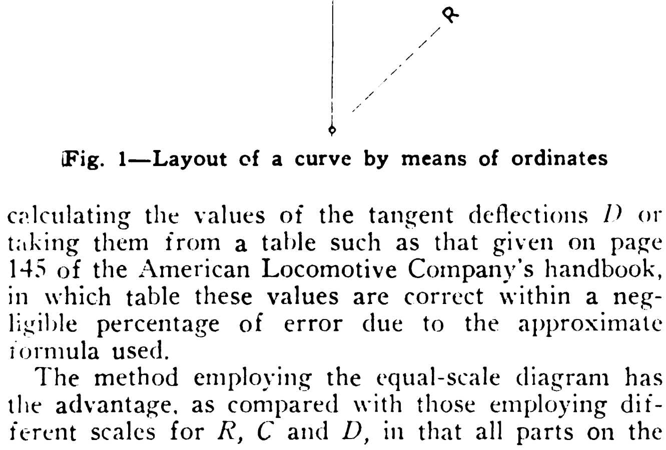


Fig. 1—Layout of a curve by means of ordinates

calculating the values of the tangent deflections D or taking them from a table such as that given on page 145 of the American Locomotive Company's handbook, in which table these values are correct within a negligible percentage of error due to the approximate formula used.

The method employing the equal-scale diagram has the advantage, as compared with those employing different scales for R, C and D, in that all parts on the layout are shown in their true relation, and the locomotive or its detail parts may be moved about in any direction relative to the rails without altering this relation. Thus, the arc described by the wheel of a pony truck rotated about the radius-bar pin center is a true arc on the equal-scale diagram, and the relation of this wheel to the rail is correct, while on a diagram having different scales for the vertical, horizontal and radius dimensions, this relation is distorted and may be very misleading.

The approximate formula for the tangent deflection D in the American Locomotive Company's tables above referred to is derived as follows:

From similar triangles, Fig. 2:

$$2R - D : C :: C : D$$

$$D = \frac{C^2}{2R - D} \qquad (1)$$

$$= \frac{C^2}{R + \sqrt{R^2 - C^2}} \qquad (2)$$

As D is small compared with R, this may be written:

$$D = \frac{C^2}{2R} \text{ (approx.)} \qquad (3)$$

all dimensions being in the same unit. With D in inches and C and R in feet, this becomes:

$$D \text{ in.} = \frac{6C^2 \text{ ft.}}{R \text{ ft.}} \qquad (4)$$

The relation between the values of D as given by the exact and by the approximate formula is:

$$\frac{D \text{ exact.}}{D \text{ approx.}} = \frac{2R}{2R - D} = \frac{2R}{R + \sqrt{R^2 - C^2}} = \frac{2R}{2R - (R - \sqrt{R^2 - C^2})} \qquad (5)$$

Let $\frac{C}{R} = a$, then $C = aR$, and:

$$\frac{D \text{ exact.}}{D \text{ approx.}} = \frac{2R}{2R - R(1 - \sqrt{1 - a^2})} \qquad (6)$$

and the percentage error due to the use of the approximate formula is:

$$-100\left[\frac{R(1 - \sqrt{1 - a^2})}{2R}\right] = -50(1 - \sqrt{1 - a^2}) \qquad (7)$$

It will thus be seen that the approximate formula gives values of D less than those given by the exact formula, and also that the error increases and decreases with a.

* This article will appear in two parts. Part II will be published in the May issue.

Again referring to the tables given in the American Locomotive Company's handbook, the value of D when C is 40 ft. and R is 200 ft. is given as 48 in. The exact value is 48.49 in. The tabular figure is thus about 1 per cent scant, which is negligible. The maximum value of a, and consequently the maximum error, in these tables is where

$$a = \frac{40}{193} = 0.207$$

Substituting this in formula (7), the error will be found to be 1.1 per cent.

A disadvantage of the equal-scale diagram is the space which it requires. Various substitutes are used to overcome this fault and make the diagram more convenient in size. Perhaps the best known is that called the "Roy" diagram, in which, by using different but properly related scales for the dimensions, it is possible to draw the curve directly with a convenient radius, to limit the horizontal scale and thus conserve space, and to show the vertical clearance dimensions full size, or at least to a large scale. The approximate formula

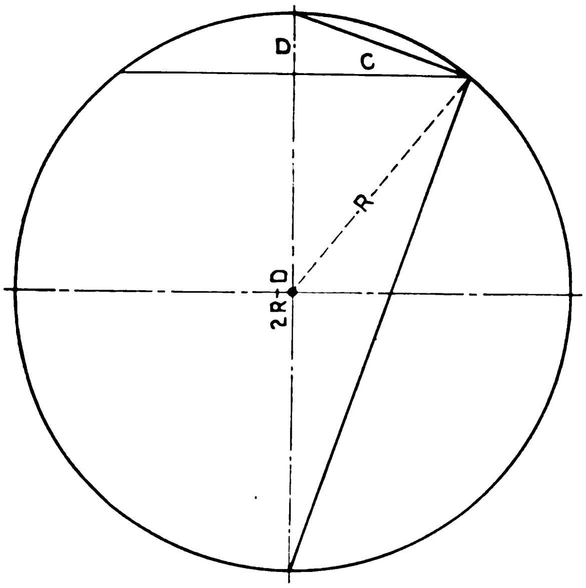


Fig. 2—Layout of similar triangles used in the derivation of the formula for determining tangent deflections

$$D = \frac{C^2}{2R} \tag{3}$$

is the basis of this method and the relation of the scales is found as follows:

Let the scale of

$$D = 1:v$$
$$C = 1:h$$
$$R = 1:r$$

Substituting in (3):

$$v = \frac{h^2}{r} \tag{8}$$

$$h = \sqrt{vr}\ (= \sqrt{r} \text{ when } v = 1 \tag{9}$$

$$r = \frac{h^2}{v}\ (= h^2 \text{ when } v = 1 \tag{10}$$

Substituting:

$$\left(\frac{1}{v}\right) D = \left(\frac{r}{h^2}\right) D = \frac{\left(\frac{1}{h^2}\right) C^2}{2\left(\frac{1}{r}\right) R} \tag{11}$$

Multiplying both sides by $\frac{h^2}{r}$ this becomes:

$$D = \frac{C^2}{2R}$$

which checks the accuracy of the scale relation.

It was shown above, in developing the method of determining the limits of accuracy of the approximate formula for tangent deflections, that the percentage of error is a function of $a = \frac{C}{R}$. As long as all dimensions are to the same scale, this ratio of one-half chord to radius is independent of the particular scale chosen and the error is similarly independent. However, when different scales are used, as in the Roy diagram, the error becomes a function of the layout dimensions and not of the dimensions which they represent to scale.

The accurate value of the tangent deflection was given above as

$$D = \frac{C^2}{R + \sqrt{R^2 - C^2}} \tag{2}$$

Taking a Roy diagram, in which D is full size ($v = 1$), this becomes

$$D = \frac{\frac{C^2}{h^2}}{\frac{R}{r} + \sqrt{\frac{R^2}{r^2} - \frac{C^2}{h^2}}} \tag{12}$$

Substituting for h^2 its value r, when $v = 1$, this is then

$$D = \frac{C^2}{R + \sqrt{R^2 - rC^2}} \tag{13}$$

Comparing formula (13) with (2), it will be seen that C^2 in the denominator of the right-hand member becomes rC^2. If r is greater than 1, the value of the denominator is decreased and D is increased. An example follows:

$C = 15$ ft.	$\frac{C}{h} = \frac{15}{30}$ ft. $= 6$ in.
$R = 600$ ft.	
$v = 1$	
$h = 30$	$\frac{R}{r} = \frac{600}{900}$ ft. $= 8$ in.
$r = 900$	

D, as obtained by the various formulas, is as follows:

Formula (2)	0.1875 ft.	=	2.25 in.
Formula (3)	0.1875 ft.	=	2.25 in.
Formula (13)	0.2260 ft.	=	2.71 in.

It will be noted that the Roy diagram as represented by formula (13), shows an error of nearly ½ in., or 20 per cent, while the error in the equal-scale diagram is not apparent to the number of decimal places taken. If the scale of D is reduced and that of R correspondingly increased, the error is reduced and formula (13) becomes

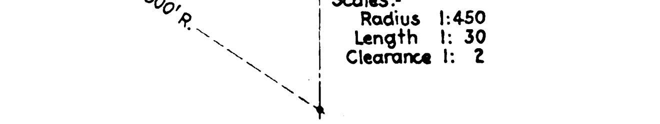


Fig. 3—A 16-ft. rigid wheel base with its wheels flanging the outer rail of a 300-ft. radius curve while the leading truck is rotated about the radius bar pin to meet the outer curved line

$$D = \frac{C^2}{R + \sqrt{R^2 - \left(\frac{r}{v}\right) C^2}} \tag{14}$$

(Concluded on page 177)

Radiography Applied To Railway Materials

By Herbert R. Isenburger*

A description of the equipment and methods used for the X-ray examination of castings and plate used in the construction of railway equipment

NONDESTRUCTIVE routine testing of critical structures has become of foremost importance. One of the most reliable methods is the radiographic examination. Thereby, shadow-pictures are obtained of the interior conditions of the object under investigation without destroying or in any way harming it. The means by which these pictures are made is a penetrating radiation of either X-rays or gamma-rays. The first kind of radiation is produced by electrical current through an X-ray tube; the latter rays which are of shorter wave length than X-rays are obtained from radium or its emanation.

A diagram of the radiographic arrangement is shown in one of the drawings. The focal spot *A* which is either the target of an X-ray tube or the bulb containing the radium, should be as small as possible in order to obtain sufficiently fine detail in the film *F*. When using X-radiation a heavy lead shielding *L* around the film holder *H* is essential in order to protect the negative from being fogged by secondary or scattered rays.

As with ordinary photographs, darker regions on the

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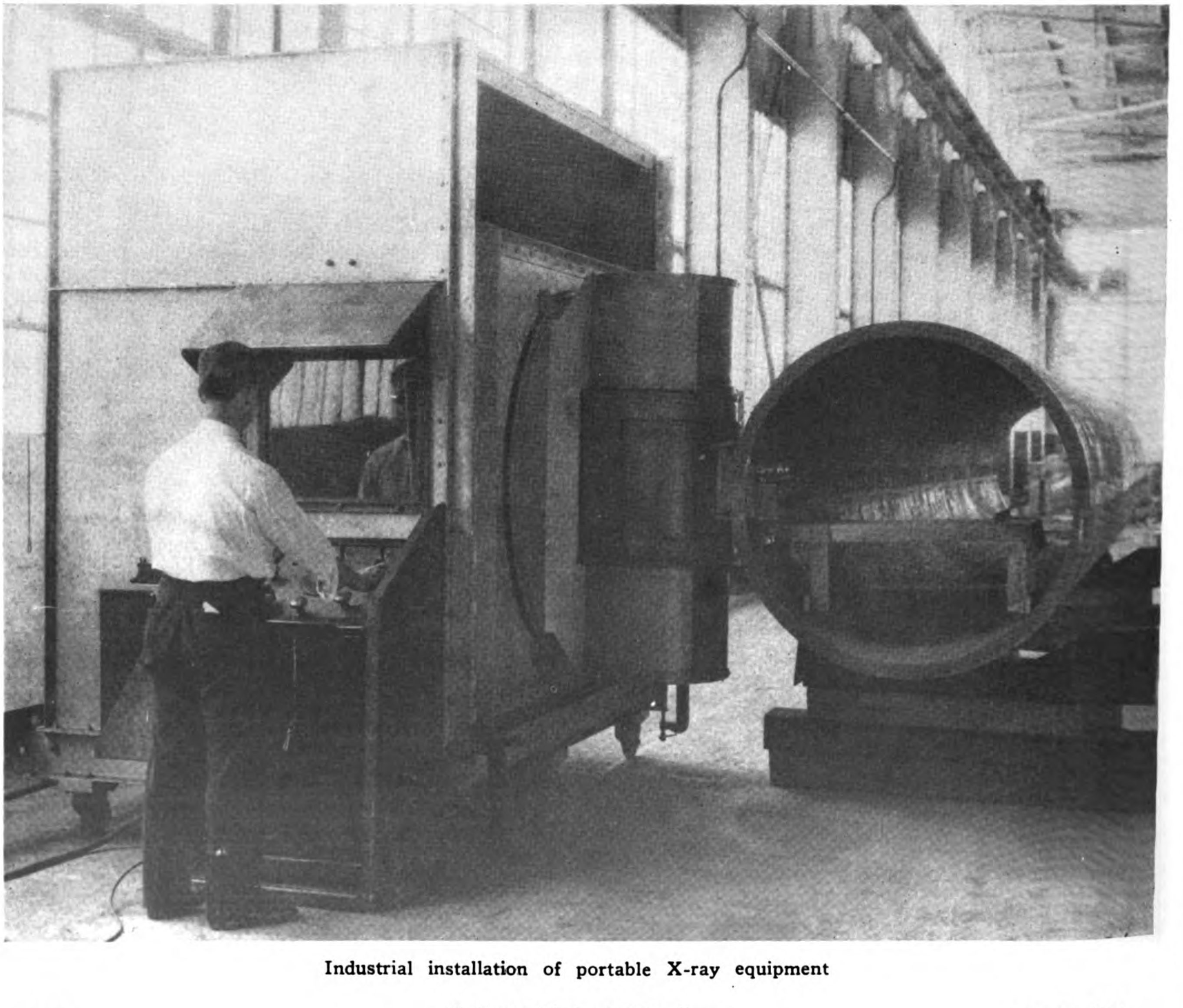
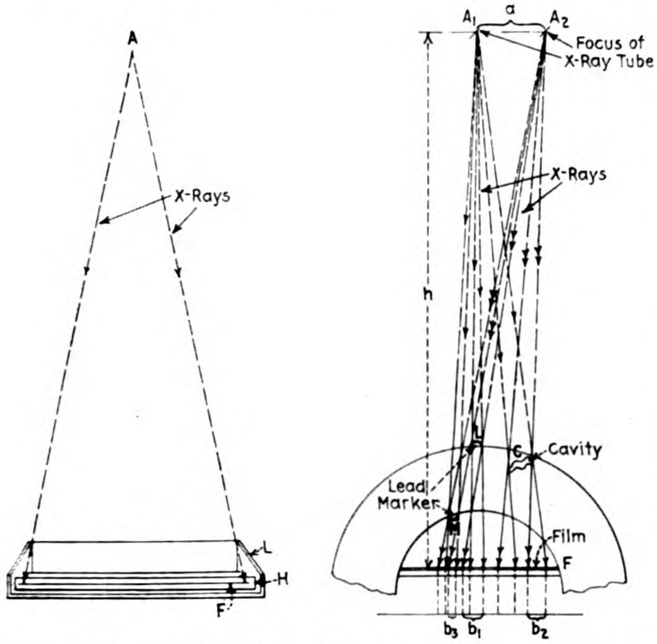


Industrial installation of portable X-ray equipment

negative or lighter regions on the print mean that more rays have passed through the object at that point which indicates that the object is more transparent there. Hence cavities will show up in the prints as light spots whereas heavy impurities or more dense metal will appear darker.

The absorption of the rays grows with the atomic weight of the material examined. It is almost propor-



Left: Diagram of radiographic arrangement—Right: Diagram showing location of sand pocket revealed in photograph shown below

tional to the third power of the atomic numbers and weights, which are shown in the following table:

Element	Atomic Number	Atomic Weight
N	7	14.00
O	8	16.00
Mg	12	24.32
Al	13	26.97
Fe	26	55.84
Cu	29	63.57
Zn	30	65.38
Mo	42	96.00
Sn	50	118.70
W	74	184.00
Pb	82	207.20

On account of its heavy atomic weight, lead is used to protect the operator, since sufficient thicknesses of lead will absorb the rays completely.

Railroad Applications of X-Ray Inspection

There are two particular fields in the railway industry where radiographic inspection is of utmost value: foundry and welding practice. In foundry practice there are two important applications of metal radiography. One of these concerns the development of manufacturing technique, the other the final inspection of the finished product. Although this method seems expensive, there are many cases where the possible failure of a casting or forging would cause damage far in excess of the cost of the examination. Here radiographic inspection becomes a matter of insurance.

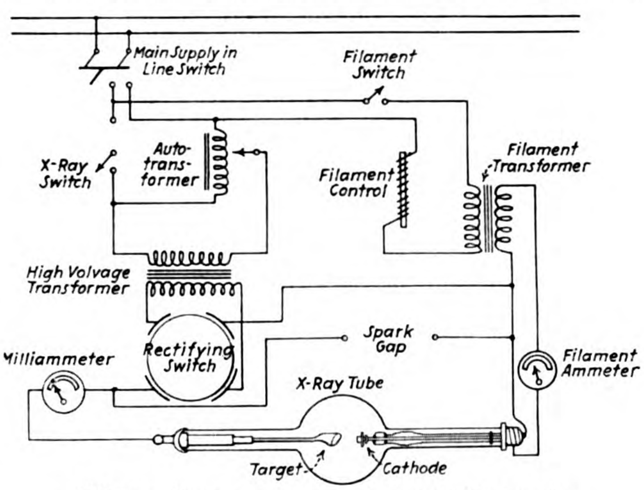
X-ray tests confirmed by cutting a section of the casting and by other means of examination indicate that the undesirable internal conditions in castings fall into relatively few classes, all of which are traceable to definite and simple causes. Most of these causes, if not all of them, can be eliminated by proper foundry practice. Experience shows that when defects have been corrected by making the required changes in foun-

Large sand pocket in 2½-in. cast steel

dry methods, they tend to stay corrected. It is thus possible, by the aid of radiography and the conclusions drawn from its results, to eliminate from 75 to 90 per cent of the more important defects in castings produced by a given foundry.

Conditions Found in Steel Castings

The principal undesirable conditions in steel castings revealed by radiographic examination are the following:



Wiring diagram of a typical installation for generating X-rays

1—Gas, slag and sand pockets due to loose dirt in the mold.

2—Gas cavities due to imperfectly deoxidized metal.

3—Sand inclusions due to cutting of the mold or runners. An illustration depicts a large sand pocket in a section of cast steel 2½ in. thick. In order to determine the depth and location inside the wall two exposures have been made on the same film as schemati-

cally shown in one of the drawings. Lead markers L and M were placed on the outer and inner surface of the castings. Before taking the second picture the source of radiation A was moved in any one rectilinear direction at a predetermined distance $A_1A_2 = a$. The distance h between focus and film was also predetermined. The film then records two images of the same cavity C and markers, L and M. The respective displacements can be measured on the film; they may be b_1, b_2 and b_3 inches. Referring to the photograph, the shadows of the reference marks on the outer surface were displaced $\frac{9}{16}$ in. or more; and the small marker on the inner surface ⅜ in. In the same way displacements of various spots in the sand pocket have been measured. It was thus determined that the inclusion lies just under the outer surface and does not penetrate more than one quarter through the wall; hence it does not cause any serious defect, and an expensive

Portion of steel casting passed by the customer's inspector as being particularly good

casting which would have been rejected was saved. This particular casting weighed over three tons.

4—Pipe or primary shrinkage caused by failure of the risers to function as indicated.

5—Secondary pipes caused by flow of viscous metal through constricted channels in the casting during the final stages of solidification.

6—Shrinkage cracks starting from a sinus-like cavity developed during cooling.

7—Rupture developed during pressure test. One of the photographs shows a portion of a steel casting which was selected by the customer's inspector as particularly good, after applying ordinary inspection tests. The radiograph revealed a sharply defined crack starting from a small cavity or inclusion. Its location was marked with crayon on the outside of the casting, and it was found where indicated when the piece was sectioned. Moreover, micrographic examination of the material adjacent to the crack showed that it had been cold-worked. The casting was probably ruined in the very test that proved it "good."

The marked progress in locomotive design and other lines of railway activities present increasingly numerous cases where such tests may be applied and where they often will be found absolutely necessary. While these conditions are perhaps more prevalent in the case of castings, they also occur with forgings as well as bar or plate stock.

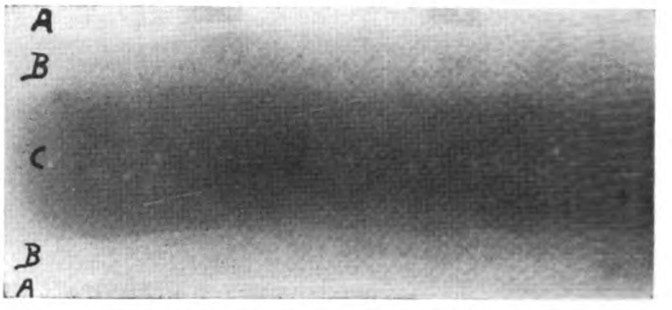
X-rays should be employed whenever advisable on steel castings and forgings having a thickness of 3 in. and less, whereas gamma-rays should be used for the examination of heavier material; 12 in. of steel have been successfully penetrated thus far. For radiographic inspection of welded seams, X-rays should be used whenever possible, since this kind of radiation gives more detail in the picture than gamma-rays. The appearance of the various defects is almost the same whether in castings or welded seams, but the precision in X-ray examination can be raised up to one per cent in 1 in. stock and less, or up to two per cent in 3-in. stock and less; but to not better than 5 per cent in gamma-ray examination; this holds good for blow holes which lie in the direction of the rays.

The location of a defect within the weld metal can be determined in a manner similar to that described, or can be calculated from the following proportion:

$$a : b = (h - x) : x$$

wherein x is the unknown distance between the defect and the film; the film being placed close to the object. In many cases this way is preferable in weld inspection where the defect is mostly a very small spot; b is the displacement of this defect.

A radiograph is shown depicting a weld in 1⅛-in. stock. In this radiograph three differently dense regions



Radiograph showing weld in 1⅛-in. stock

appear: Region A represents the plate, region B the built-up metal on the surface toward the X-ray tube, and region C which contains the actual weld and shows the built-up metal on the side facing the film. Although this is a porous weld it may be considered permissible for the service intended. Here lies the danger of radiographic tests of welded seams: that the picture may show an apparently bad condition which actually is permissible. In this respect X-ray inspection tends to be

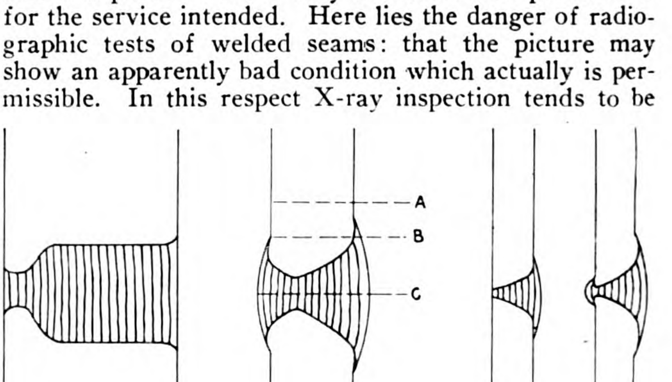


Fig. 1: Sketch showing radiograph of a sound weld in 2-in. plate stock—Fig. 2: Sketch of weld from radiograph shown above—Fig. 3: Weld shown in illustration of test plates from ⅝-in. stock—Fig. 4: Sketch of a good gas weld

a rigid test, calling for skill in the interpretation of the film combined with thorough knowledge of the material's ultimate use. Its results have to be studied carefully and whenever possible, expert advice should be obtained. For certain purposes, of course, welds, as shown in the picture of the 2-in. plate stock are preferable. That they can be made and are being produced frequently has been proved by the X-ray.

Two of the X-ray pictures show electric arc-welded test plates from ⅝-in. stock made by the same welder.

The top view as originally submitted for X-ray examination; and the lower view made after a thorough study of the X-ray evidence which revealed that the soundness of a weld depends not only on the answers to the preceding questions, but also on the quality of the rod and its coating, the way the welder holds the arc and the speed by which the joints are being fused together.

All welds illustrated thus far were made with the electric arc. It is equally important to inspect gas welds. Another radiograph depicts an acetylene weld which is rather good. Notice the built-up metal over the bottom of the V in contrast to the two X-ray pictures referred to in the preceding paragraph which represents the type of weld used for joining small size tubings which cannot be welded from the inside.

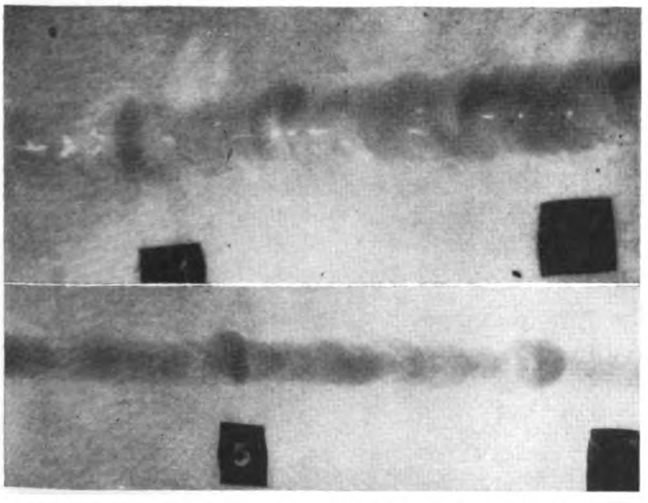
The following questions concerning welding can be answered with X-ray pictures:

Is a weld sound throughout?
Are there any inclusions of gases, slags, sand or other impurities?
Was there any undesired absorption of gas?
Is the welding rod of the proper size and was the current density appropriate?
Is a weld burned?
How did the fusion turn out (thorough penetration)?
Did any cracks develop within the welded section or the neighboring region and what causes such shrinkage?
Are there any thinner spots within the weld metal caused by improper welding procedure?
Were there any repairs made afterwards, like caulking copper welds?

In this way, not only can the welding process be improved, but work can be controlled and bettered.

Comparatively little radiographic work has been done in the railway industry in this country whereas the German State Railways uses it to considerable advantage. The management has an elaborate X-ray laboratory in its machine shops at Wittenberge near Berlin and also equipment mounted on cars with living quarters for the operator that can be sent any place where it is desired to inspect material.

The cost of suitable X-ray installations and their operating expense depend a great deal on the materials



Electric arc-welded plates from ⅝-in. stock—See Fig. 3

to be examined. The figures given below can therefore only be approximate estimates for average performances and requirements. The type of installation to be used for various inspection work depends largely upon the nature of the material, its thickness, conditions and mobility. A conservative estimate of operating cost is $3.00 to $5.00 per hour, depending on the way the equipment is written off. The cost of radiographic inspection by means of gamma-rays is difficult to estimate. The radio-active material can be rented for a certain time and in most cases the expense for such work equals the cost when X-rays are used. There are certain cases where it is easier to bring the radium to the job than X-ray equipment although the thickness of the material may be within the X-ray limits. X-rays should, however, be employed whenever possible, since they bring out better contrast and more details in a much shorter exposure time.

X-ray equipment, however, should not be installed until the adaptability of the method to the problems in hand has been demonstrated, and not then unless the benefits to be derived justify the investment. This would seem to make the tool unavailable to the organization with a small problem or a temporary difficulty.

Layouts of Locomotives On Curves

(Continued from page 173)

Thus, if we use

$$v = 2 \quad h = 30 \quad r = 450$$

in the above example, the error is reduced to 4 per cent.

Even with the scale of D reduced, there may still be considerable error under some conditions. Taking a scale relation which has been used in laying out electric locomotives on curves,

$$v = 8$$
$$h = 80$$
$$r = 800$$

Let $C = 20$ ft. $\qquad \frac{C}{h} = \frac{20}{80}$ ft. $= 3$ in.

$R = 359$ ft. (16-deg. curve) $\qquad \frac{R}{r} = \frac{359}{800}$ ft. $= 0.449$ ft. $= 5.39$ in.

D is as follows:

Formula (2) 0.558 ft. = 6.70 in.
Formula (3) 0.557 ft. = 6.68 in.
Formula (14) 0.609 ft. = 7.31 in.

The error in this case is nearly ⅝ in., or 9 per cent.

It will be understood that wherever a percentage of error is given above, it corresponds to a particular value of C and increases or decreases with C.

Another, and usually more serious, source of error in the use of this diagram has already been noted; that is, the distortion of circular arcs due to the difference in scales. Fig 3 will make this clear.

Here the scale ratios are:

$$v = 2 \quad h = 30 \quad r = 450$$

and a 16-ft. rigid wheel base is shown with its extreme wheels flanging the outer rail of a 300-ft. radius curve, while the leading truck center is rotated about the radius bar pin to meet the outer curved line. The point of intersection of the arcs is nearly 26 in. to the left of its true position, but this is partly balanced by the error in the curved line, resulting as follows:

Truck lateral displacement, exact................	4.27 in.
Truck lateral displacement, by diagram..........	3.60 in.
Error	0.67 in. (16 per cent)

The scales chosen for the above example may, of course, be modified so as to minimize the error, but it may be laid down as a general rule that the more compact the diagram, the greater the liability of error.

[In the continuation of this article unequal-scale diagrams other than the Roy will be discussed, which give more accurate and reliable results.—EDITOR]

Handling Coach Repairs On the Florida East Coast

Complete facilities for making heavy repairs and painting passenger equipment are installed at the Miller shops, St. Augustine, Fla.—Wheel shop handles repairs for the system

THE principal car and locomotive repair shops of the Florida East Coast are located at St. Augustine, Fla. These shops, which are known as the Miller shops, were built in 1925 and 1926 as part of a general improvement program that was inaugurated at that time. The Florida East Coast owns and operates 170 passenger-train cars and a considerable number of miscellaneous business and work cars which are maintained at the Miller coach shops. A high standard of maintenance is required, especially during the winter tourist season when passenger traffic is heavy. The railroad operates a considerable number of through-passenger trains, such as; the "Havana Special," the "Royal Poinciana," the "Florida Special" and "The Miamian."

St. Augustine is located 37 miles from Jacksonville, Fla., the northern terminus of the Florida East Coast. The larger part of the southbound through-passenger train service originates from connecting lines at Jacksonville. The close proximity of St. Augustine to the northern terminus of the railroad places the Miller shops in a strategic location from the standpoint of coach repairs.

Architecture of Shop Buildings Follow Spanish Style

As shown in several of the illustrations all of the buildings comprising the Miller shops follow the Spanish style of architecture. The style harmonizes with the scenery and traditions of the surrounding country and is well adapted to the climate. Palm trees set around the shop buildings considerably enhance the general appearance of the buildings and grounds.

The shops are located on the west side of the main tracks from St. Augustine to Jacksonville. Cars may be brought into the shops from either direction and switched to the west end of the transfer table. However, the usual procedure is to switch cars into the coach-shop yard from the south end.

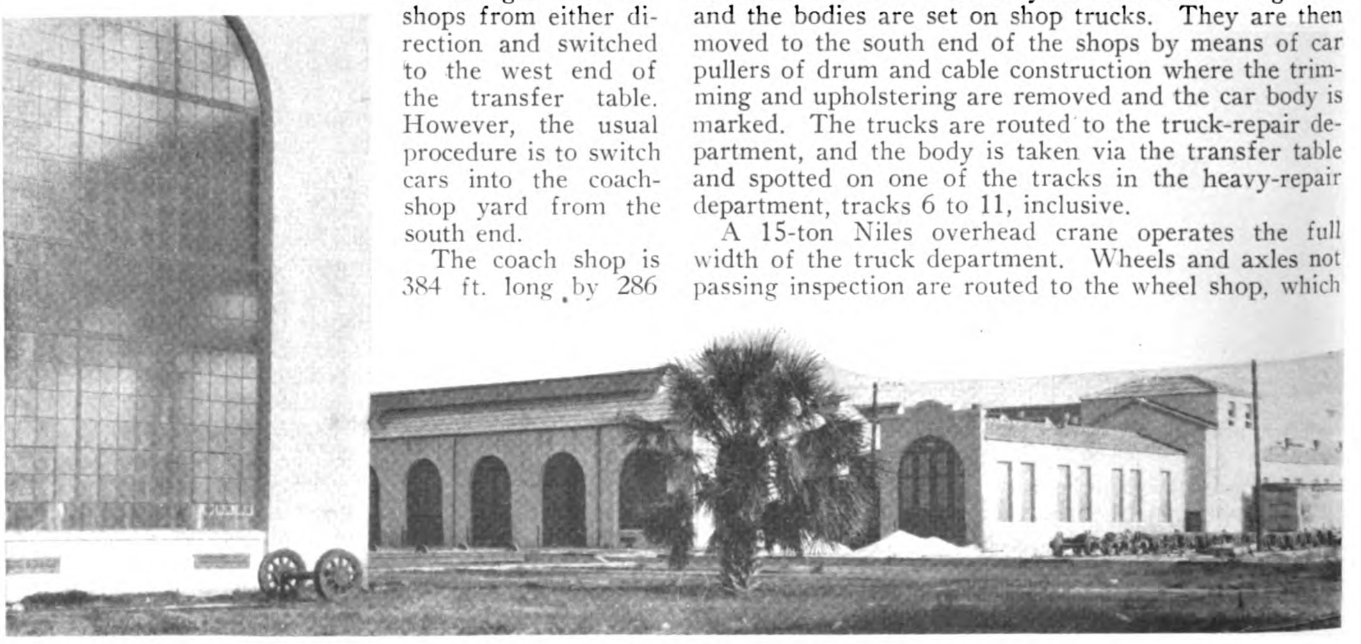
The coach shop is 384 ft. long by 286 ft. wide. A partition wall divides the building into two parts, the repair shop being located on the west side and the paint shop on the east. Eight-foot concrete roadways are provided, as shown in the drawing, for the trucking and handling of materials.

A coach storage shed, 288 ft. long by 73 ft. wide, is located south of the coach repair shops. Five tracks lead into this building from a ladder track which is a continuation of track 15 from the east side of the paint shop. A building for sand-blasting is located on the west side of the coach shops on track 2 leading to the transfer table. It will be observed from the drawing showing the layout of the shop tracks and buildings that the facilities for handling coach repairs are well arranged and convenient for the production of all classes of repairs.

Routing Cars Through the Shop

Cars requiring body and truck repairs are brought into the shop over tracks 1, 3 or 4 and moved via the transfer table to track 5 in the coach repair shop. The tracks in both the repair and paint shops are spaced 22 ft. apart, center to center. The coaches are unwheeled at the north end of track 5 by means of a Whiting hoist and the bodies are set on shop trucks. They are then moved to the south end of the shops by means of car pullers of drum and cable construction where the trimming and upholstering are removed and the car body is marked. The trucks are routed to the truck-repair department, and the body is taken via the transfer table and spotted on one of the tracks in the heavy-repair department, tracks 6 to 11, inclusive.

A 15-ton Niles overhead crane operates the full width of the truck department. Wheels and axles not passing inspection are routed to the wheel shop, which



Miller coach shops—Sand-blast building and wheel storage at the right

is located west of the locomotive shop, as shown in the drawing.

The coach repair department is served by ½-ton chain hoists hung from mono-rail trolleys. Two hoists are provided for each mono-rail, one of which extends along each side of each repair track. Adjustable scaffolding of steel construction is installed along each of the repair tracks.

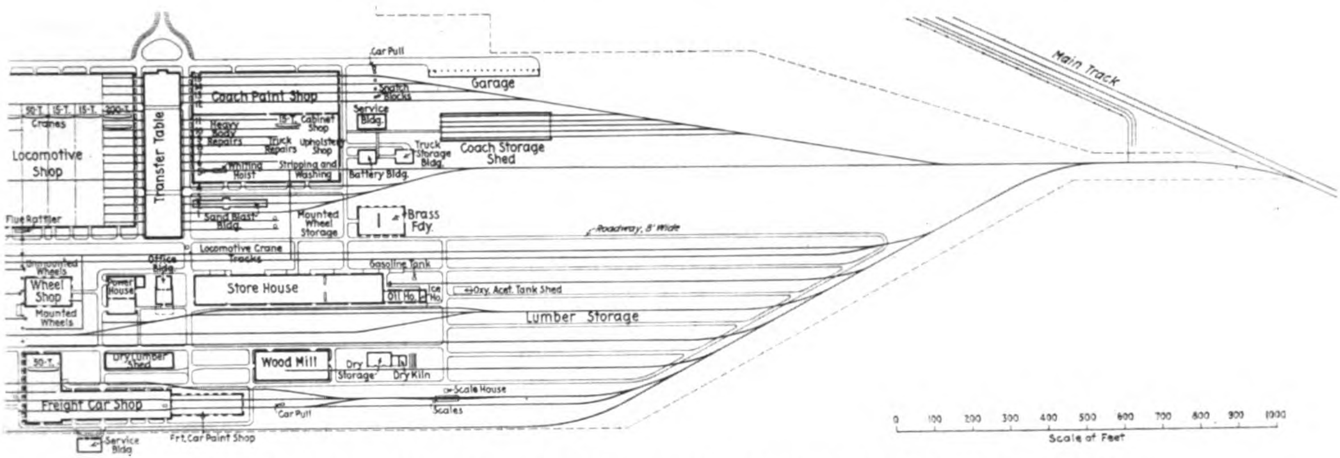
A feature of the facilities provided for the coach-repair department is a frame for straightening car frames and steel body sides. This frame consists of 14 perpendicular columns, seven on each side, placed along track 5 at the south end of the pit at the Whiting hoist. The columns are heavy channel sections connected by horizontal steel-channel sections, laid underneath the track in 8 in. of concrete, to the column directly opposite. Frames are straightened by means of jacks placed between the columns and the side of the car or frame.

The carpenter, pipe, blacksmith and electrical shops are arranged along the west side of the shops between the outside wall and track 5. The car washing floor at the south end of track 5 slopes to two drains between the west wall and track 5 and to two drains located between the rails. The upholstery shop is arranged along the south wall between track 5 and the center partition wall. The cabinet shop, tool room and trim shop occupy the bay between the upholstery and truck shops.

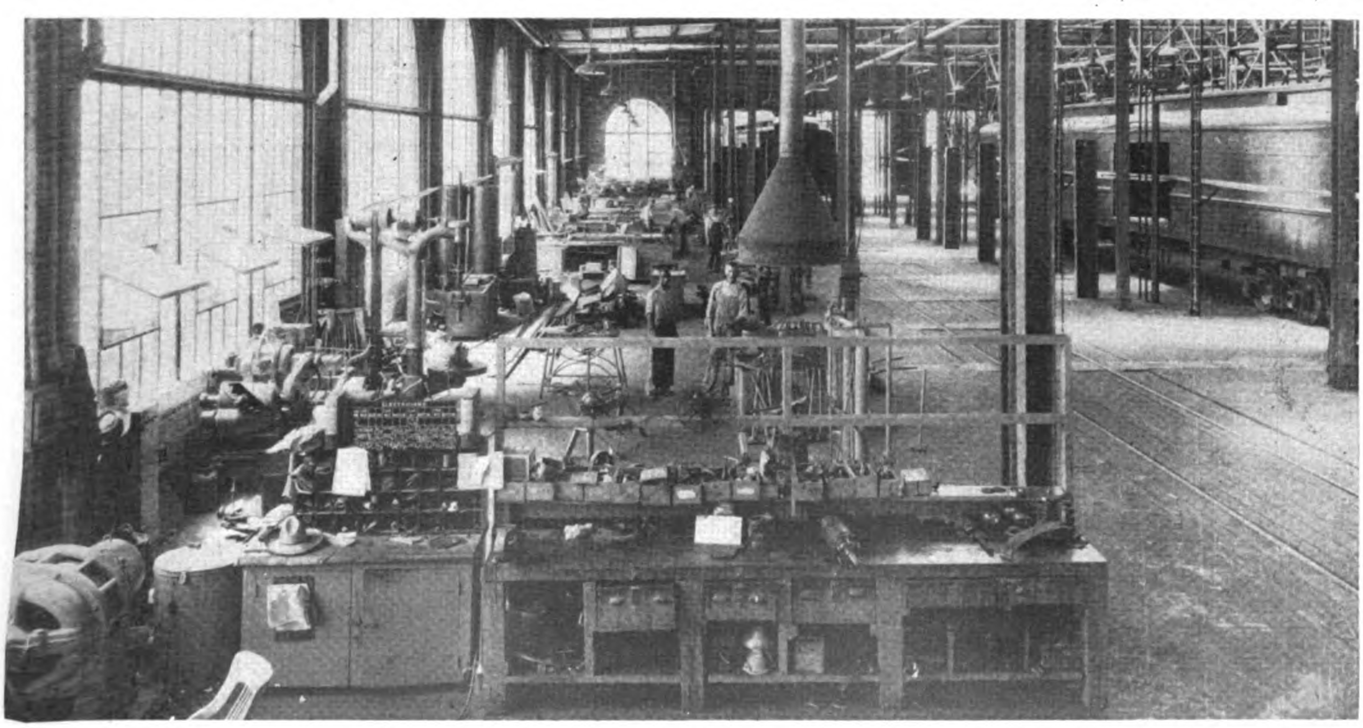
The Paint Shop

Coaches to be repainted are moved from the washing floor to the paint shop via track 5. Steel cars in bad condition are sandblasted and primed with metal frames. This is followed with three coats of Glidden surfacer. The primer coat is allowed to stand for 36 hr. Twenty-four hours are allowed between coats of surfacer.

The final surfacer coat is rubbed down with wet and dry sandpaper, after which two coats of Flood & Conklin Simplex coating, Pullman finish color, are applied. The cars are lettered with gold leaf after which three coats of varnish are applied. The entire exterior ap-



Layout of the car-department repair facilities at the Miller shops of the Florida East Coast



Interior of the coach repair shop—The columns for straightening frames are shown in the background

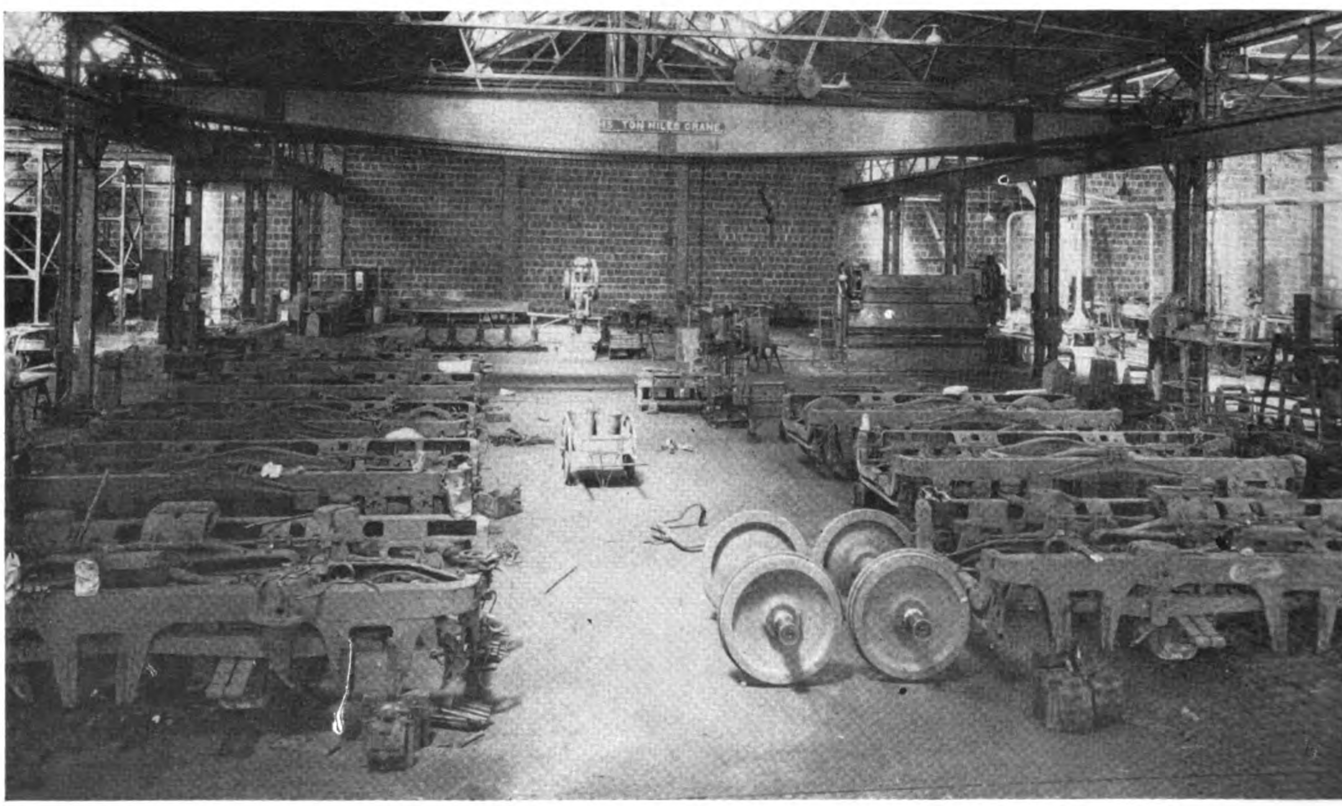
plication is made by the spray process, with De Vilbiss equipment.

The interior of the cars are also sandblasted. Two coats of lead are sprayed over the interior which is followed by paint in two shades of gray, also applied by the spray process, which is used for all paint work, including the trucks. Ceilings of coaches are finished in light gray. The ceilings of baggage cars are painted white with the side walls done in ochre enamel.

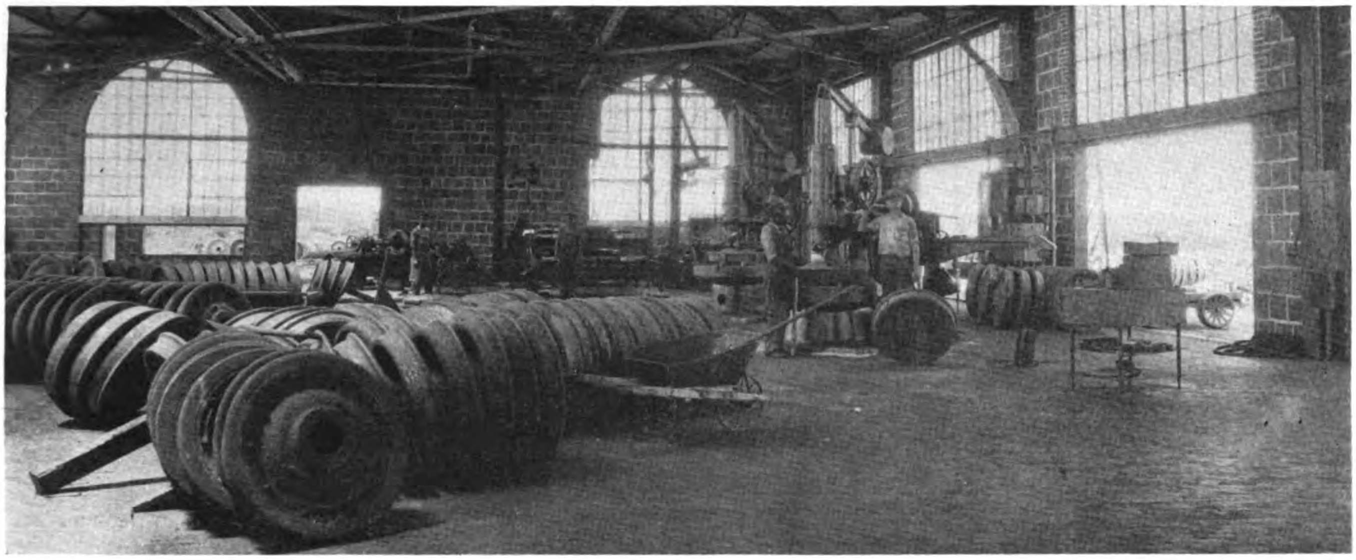
Sash and furniture is burnt off when necessary and built up with wood primer. One coat of wood primer is applied, followed by two coats of surfacer, which is rubbed, two coats of color and two coats of varnish.

List of Machine Tools and Equipment in the Miller Coach Shops of the Florida East Coast Line at St. Augustine

Number	Manufacturer and Size	Kind of Machine
	Upholstery Department	
3		Sewing machines
1		Curtain cleaning vat
1		Seat and cushion cleaning and drying outfit
1		Carpet rack
1	Atlas	Hair picker
	Pattern Department	
1	Fay & Egan	Patternmakers' lathe
1	Fay & Egan	Jib saw
1	Universal, No. 6-E	Wood trimmer
1		Pattern-number former
	Blacksmith Department	
1		Forge
1		Anvil
1		Power hammer
2		Face plates
	Wood Working Department	
1	Fay & Egan, No. 418	Gainer
1	Fay & Egan	Saddle gainer
1	Fay & Egan, 48 in.	Band saw
1	Fay & Egan, No. 500	Rip saw
1	Oliver, No. 2	Wood trimmer
1	Oliver, No. 3	Wood trimmer
1	Fay & Egan	Wood lathe
1	Fay & Egan, No. 454	Disc sander
1	Fay & Egan, No. 224, 24 in.	Surfacer
1	Fay & Egan, No. 264	Rip saw
1	Fay & Egan	Cut-off saw
1	Fay & Egan, No. 209	Universal wood worker
1	Fay & Egan, No. 214	Hollow chisel mortiser
2		Bench planers
1	Fay & Egan, No. 505	Tenon machine
	Tool Room	
1		Band saw filing machine
1	Mummert, Dixon Co.	Tool grinder
1	Fay & Egan	Planer knife grinder
1	Ranson	Dry grinder
	Steel Working Department	
1	Three-head	Bolt threader
2	Berwick	Electric rivet heaters
1	Cincinnati Shaper Co.	Forming press
1	Fay & Egans, No. 50	Metal band saw
1	Pels	Punch and shear
1	American, 3-ft.	Radial drill
1	Cincinnati	High-speed drill press
1	Aurora, 32-in.	Drill press
	Truck Department	
1	Niles, 15-ton	Over-head traveling crane
1		Spring tester
1	Watson-Stillman, 30-ton	Press
	Pipe Department	
1	Landis, 4-in.	Pipe threader
1	Underwood	Pipe bender
1		Forge
1		Anvil
	Sheet Metal Department	
1	Dreis & Krump, 10-ft.	Brake
1	3-ft.	Forming rolls
1	8-ft.	Cornice brake
2	Peck, Stow & Wilcox	Circle shear
1	Peck, Stow & Wilcox, 36-in.	Hand brake
2	Peck, Stow & Wilcox	Hand shear
1	Peck, Stow & Wilcox, 52-in.	Squaring shear
1	Peck, Stow & Wilcox, 36-in.	Squaring shear
1	Peck, Stow & Wilcox, 54-in.	Rolls
1	Peck, Stow & Wilcox, 48-in.	Foot brake
1	Peck, Stow & Wilcox	Hand punch
1	Peck, Stow & Wilcox, 30-in.	Bending rolls
1	Peck, Stow & Wilcox, 30-in.	Bar folder
1	Peck, Stow & Wilcox	Combination former
4		Revolving machine standards
1	Marshalltown	Throatless shear
	General Equipment in Coach Repair and Paint Shops	
1	Whiting electric	Coach hoist
2	Godfrey	Car pullers
1		Set straightening frames
	Paint Shop Equipment	
1	DeVilbiss	Paint spraying system
1	Gehnrich	Enameling oven
	Electric Department	
1	General Electric	Motor generator set



The truck-repair department



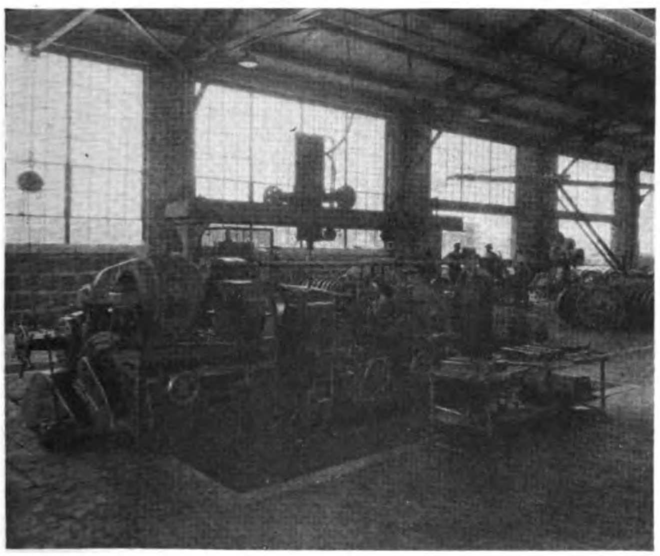
The wheel shop—Unmounted wheels are brought into the shop through the door at the right

Enameled toilet hoppers and basins are sandblasted after which two coats of undercoating are applied followed by two coats of white-enamel finish. They are then baked for three hours in a Gehnrich indirect-heat oven at 200 deg. F.

Eight painters working on car bodies and four men in the sash department turn out three cars per week. Cars are moved in and out of the paint shop with a cable car puller.

The Wheel Shop

The wheel shop is located west of the locomotive shop, as shown in the drawing. It is 72 ft. wide by 120 ft. long and of the same design and construction as the coach shop. Unmounted wheels are stored in the area east of the wheel shop, while mounted wheels are stored in the area opposite or west of the building. In addition to wheels removed in the coach and freight-car departments at Miller shops, the wheel shop maintains wheels for the entire system.



Niles car-wheel lathe in the wheel shop

Wheels, on being unloaded, are cleaned and given an A.R.A. inspection. All wheels marked OK by the inspector on the line are checked on arrival at the wheel shop, where they are taped, remated and mounted. It is estimated that remating wheels saves the road from $6,000 to $7,000 annually. Occasionally wheels marked OK by an inspector will not pass the wheel-shop inspection. Such wheels are set to one side and stored until inspected by the car inspector who then takes the matter up with the inspector who marked the wheel OK.

List of Machine Tools and Equipment in the Miller Wheel Shops of the Florida East Coast Line at St. Augustine

Number	Manufacturer and Size	Kind of Machine
1	Pond	Double axle lathe for rolling journals
2	Niles, No. 2	Double axle lathes
1	Betts, 52-in.	Car-wheel borer
1	Niles, 48-in.	Car-wheel borer
1	Hisey-Wolf	Emery grinder
1	Niles, No. 3	Car-wheel lathe
1	Niles, 400-ton	Wheel press
1		Wheel-starting press

Axles are removed and handled separately by monorail through the wheel shop. If calipering shows the wheel fits to be oversize, the operator of the wheel borer is informed and wheels are bored accordingly. All axles are placed in a lathe to test for straightening before they go out of the shop. All journals are rolled and polished.

THE FIRST RAILROAD in the Mississippi Valley and one of the first railroads in the world to adopt the standard gage was the West Feliciana Railroad, between St. Francisville, La., and Woodville, Miss., now a part of the Illinois Central.

This railroad will soon reach its 100th birthday. It was chartered by the state of Louisiana on March 25, 1831. At that time railroads were in the experimental stage and there was much controversy among railway engineers in England and the United States concerning the most practical gage to adopt. George Stephenson, the inventor of the locomotive, was advocating a gage of 4 ft. 8½ in.; Brunel, another noted engineer, was building a railroad with a 7-ft. gage, the broadest railroad the world has ever known. In the United States there were railroads building and proposed with gages of 4 ft. 9 in., 4 ft. 9¼ in., 4 ft. 10 in., 5 ft. and 5 ft. 6 in. The first Southern railroad, in South Carolina, had a gage of 5 ft.

At the time the West Feliciana Railroad was organized in 1831, there were only two or three short railroads in England of 4 ft. 8½ in. gage and one in the United States—the Baltimore & Ohio, then only a few miles long. It was not until after the Civil war that 4 ft. 8½ in. became the standard gage for steam railroads in the South.

Stug System of Firing Pulverized Fuel*

By R. Roosen

BOTH of the 2-10-0 type locomotives built with the Stug system for the German State Railways described in the March issue were first tried on several runs on the German State Railways' lines near Kassel. Thus schedule freight trains were hauled on the section from Kassel to Eichenberg, which has numerous curves and long inclines of 1 in 100. The weight of these trains was about 1,200 to 1,300 tons. On level track it was generally possible to run with only one burner in action, while on the heavy gradients, when both burners had to be operated, the locomotive was working at its full output of about 1,400 hp. at the tender drawbar.

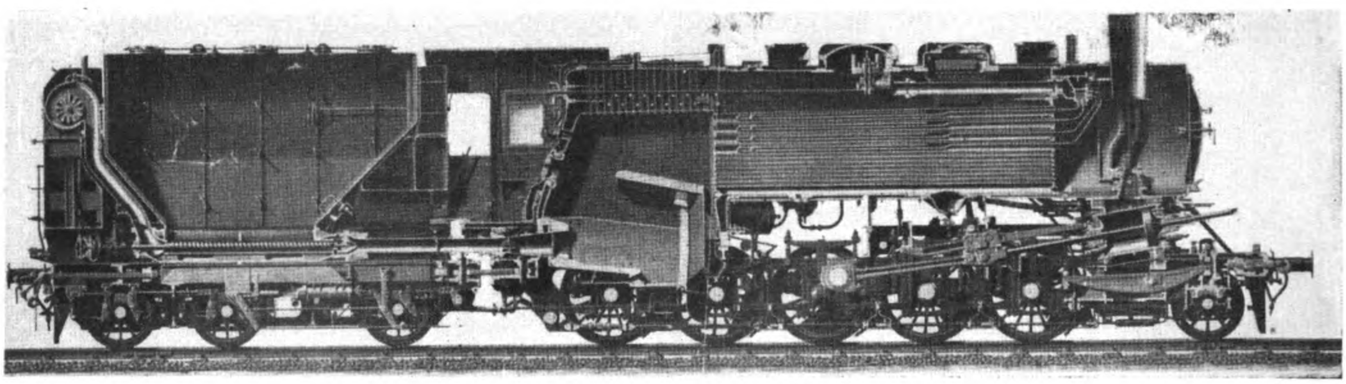
These trial runs fully demonstrated that the locomotives came up to all expectations as to their adaptability to running conditions, simplicity of operation, and reliability of the pulverized-fuel burning equipment. Full steam pressure could easily be maintained, and there was no difficulty in preventing steam from blowing off when passing from gradients to level or down grades. When running down steep gradients, both of the burners could be cut out, so that the auxiliary burner alone was in operation. When restarting the main burners, ignition was readily made by the auxiliary burner flame.

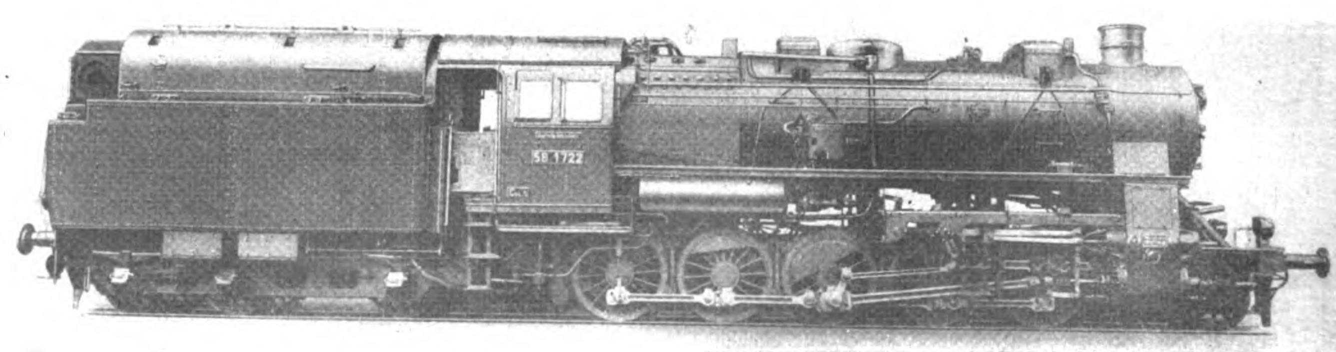
These trial runs were carried out on lignite dust developing about 9,000 B.t.u. per lb. Combustion of the dust was perfect, the flue gases emitted through the chimney were colorless, and even on night runs no sparking was observed. Even while the locomotive was running very slowly, so that the exhaust puffs succeeded each other at relatively long intervals, there was an unimpeded flow of the flue gases.

On the strength of these results, one of these locomotives was assigned in May, 1929, to the Halle district of the German State Railways, where it has been in service ever since, with a considerable saving of fuel and furnishing a valuable occasion for collecting road experience. Particulars in this respect will be given in connection with other G-12 class engines adapted for the Stug system later and likewise assigned to the Halle district. The economical success achieved will also be dealt with.

The other of these two locomotives was submitted to a series of thorough trial runs by the German State Railways' testing department at Grunewald (near Berlin), during the summer and fall of 1929. On such trial runs, the locomotive is coupled to a dynamometer car with a brake locomotive in the rear. The brake locomotive compresses air in its cylinders, which is exhausted through the chimney, so that the resistance can be adjusted to any desired amount. The locomotive under trial can therefore be examined with constant output and for any distance, independent of road conditions. All factors of interest, such as fuel and water consumption, boiler efficiency, temperature, and composition of

* Part II of the report on the Stug system of firing pulverized fuel.





Longitudinal section and side view of a Stug 2-10-0 type locomotive of latest design

nue gases, can thus be checked at various speeds and compared with each other. The runs were made under conditions varying from no-load to top boiler output of 12.3 lb. per sq. ft. per hour. The dust consumption is determined by weighing the tender before and after the run.

The rate of coal-dust consumption and the boiler efficiency gave entirely satisfactory results. In all of these runs, the whole of the air required for combustion was injected through the burners (primary air supply), an improvement of the boiler efficiency being expected as against drawing part of the air direct through the ashpan into the firebox (secondary air supply). It was indeed possible to reduce the excess of air in combustion to about 20 per cent, corresponding to a CO_2 content of about 15 per cent, combustion being very satisfactory. It appeared, however, that with varying loads as experienced in actual service the advantage of introducing 100 per cent of the air for combustion as primary did not amount to much. Therefore, simultaneously with the trials of the first two locomotives by the State Railways, the Stug proceeded with a series of experiments on its test plant at Kassel, during which part of the air was blown through the burners and the remainder was drawn in through the ashpan. This method was necessary for the burning of hard-coal dust, which was then under trial at Kassel, and it furnished conclusive results also with lignite dust. On the basis of these results obtained at Kassel, the Grunewald locomotive was submitted to another series of tests with part of the air drawn in through the ashpan. The results were nearly the same as in the former series of tests, that is, entirely satisfactory. In order to furnish a basis for comparison with a conventional type locomotive, a normal grate-fired class G-12 locomotive was put to test under the same conditions. The boiler efficiency of the coal-dust fired locomotive was around 78 per cent under all loads, which, in the case of top load, was about 9 per cent above the grate-fired locomotive, while with small loads there was less difference. The heat expenditure in the fuel, related to the drawbar horsepower, was accordingly 9 per cent lower with peak loads. The steam consumption of the auxiliary machines on the tender is of course included. It amounted to about 5 per cent of the steam generation of the boiler. The combustion of the dust was complete. The composition of the flue gases will be seen from Table III, which gives figures obtained in the course of trials made with the Stug system under loads as applied during the Grunewald runs. After these tests had been carried out to entire satisfaction, the Grunewald locomotive was also assigned to the Halle district for regular service.

While the two aforementioned locomotives were undergoing trials by the State Railways, experiments on the test stand at Kassel were continued. The aim was to ascertain to what extent manufacturing could be simplified and cheapened. The tests chiefly bore on the possibility of driving the blowers and conveyor worms by one turbine, thus eliminating the steam motor which had been provided at the State Railways' request for the worm drive. It appeared that this simplified drive succeeded well if the air and dust supply were regulated so as to give a correct proportion at any turbine speed. Control of the furnace output from top load to minimum load (a range of about 1 to 8) was also obtained by just varying the turbine speed, one burner being cut out in the case of smaller loads. The auxiliary burner worm and blower, too, could be dispensed with in this way, since no-load performance of the engine could be maintained with one main burner in gear at reduced turbine speed. The equipment was thus greatly simplified.

In the course of these trials, which were made with a view to obtaining greater simplicity, the behavior of the ash was given further attention. It is known that the larger part of the ash is carried away through the stack, the remainder, however, remaining in the ashpan. A perfect pulverized-fuel firing system must avoid the formation of troublesome honeycombing on the tube sheet. This important problem, therefore, may be given more detailed consideration.

The tendency of the ash to form deposits depends on the temperature at which it will begin to soften and fuse. The combustion in the furnace, therefore, must be accelerated so that the ash will have cooled down below these temperatures before it hits the tube sheet. The temperature limit for this purpose lies between 1,940 and 2,480 deg. F. for most types of coal. As it appeared from the tests, such acceleration is obtained by using dust ground to a sufficient degree of fineness, ensuring a perfect mixture of the dust and primary air, adequately timing the air supply to the firebox, a perfect mixture of the gases with the secondary air, and in the case of coal with little volatile constituents a certain preheating of the primary air by exhaust steam from the tender turbine. In this way the Stug succeeded in avoiding honeycombing totally, or at least to such an

Table III—Tests Made in the Mittelfeld Testing Plant on Lignite Fuel

Date	10–11–29	1–10–10	9–25–29	8–29–29	1–9–30	10–18–29
Test No.	25	34	18	15	33	28
Lower heating value, B.t.u. per lb.	9,604	9,366	9,364	9,432	9,366	10,052
Residues on 170-mesh screen, per cent	23.96	17.60	17.18	19.20	17.60	28.32
Fuel consumed, lb. per hour	1,415	2,900	3,197	3,792	4,520	4,211
Firebox heat output, B.t.u. per cu. ft. per hour	0.606×10^5	0.836×10^5	1.33×10^5	1.6×10^5	1.89×10^5	1.895×10^5
Evaporation, lb. per hour	9,017	12,081	19,048	23,149	26,279	26,522
Temperature of feedwater, deg. F.	208	201	210	217	205	212
Coefficient of evaporation	6.37	6.04	5.97	6.10	5.82	6.30
Evaporation of heating surface, lb. per sq. ft. per hour	4.32	5.80	9.12	1.11	12.6	12.68
Boiler pressure, lb. per sq. in.	201.9	199.1	200.5	201.9	201.9	201.9
Average temperature of superheated steam, deg. F.	639	651	714	711	738	741
Average temperature of flue gas in smokebox, deg. F.	554	576	639	642	705	709
Analysis of flue gas: CO_2, per cent	13.2	13.0	12.9	14.8	13.8	14.4
Analysis of flue gas: O_2, per cent	6.0	6.4	6.4	4.4	5.6	5.0
Analysis of flue gas: CO, per cent	0.0	0.0	0.0	0.1	0.1	0.1
Boiler efficiency, determined from flue-gas losses, per cent	77.2	76.2	76.7	77.2	75.8	76.0
Free heating surface in firebox (not brick-lined), sq. ft.						131.6
Heating surface in tubes, sq. ft.						1945.1
Total heating surface, sq. ft.						2076.7
Firebox capacity, cu. ft.						211.9

$$\frac{\text{Free heating surface in firebox (sq. ft.)}}{\text{total heating surface (sq. ft.)}} = \frac{131.6}{2076.7} = \frac{1}{15.8}$$

$$\frac{\text{(Firebox capacity (cu. ft.)}}{\text{total heating surface (sq. ft.)}} = \frac{211.9}{2076.7} = \frac{1}{9.79}$$

extent that no trouble was experienced with it. It is noteworthy that these results were obtained in the small firebox of the German State Railways' G-12 class locomotive in which a firebox output of 235,000 B.t.u. per cu. ft. is produced with top loads. It is obvious that conditions must be more favorable with American locomotives having a larger firebox volume and often a combustion chamber. With such designs, temperatures can be kept so low that the inconvenience of honeycombing is easily avoided.

These investigations were instrumental in proving that hard coal and many types of foreign coal, such as Brazilian, Austrian, and Russian, which may be available for pulverized-fuel firing, can be fired to full advantage, the preceding Stug tests having demonstrated that the problem was solved in every respect so far as lignite dust was concerned. (See Table IV, referring to tests with hard coal.) In these hard-coal tests, the burner head was slightly modified where it joins the firebox, and the primary air was preheated to about 200 deg. F. by exhaust steam from the turbine. The hard coal used had no more than about 20 per cent of volatile constituents.

Similar results were obtained in burning dust from low-temperature lignite coke having only about 10 per cent volatile constituents.

As mentioned before, these tests, the purpose of which was the extension of pulverized-fuel firing to types of coal other than lignite, were carried out simultaneously with the trial runs of the first two lignite-dust-fired Stug locomotives on the German State Railways' lines. The experience collected by these further tests made at Kassel, and in particular the simplifications of equipment described, were of course taken advantage of in the construction of the further locomotives which were adapted for coal-dust firing by Henschel & Sohn on the German State Railways order, on the strength of the good results they had obtained with the two first ones.

These further State Railways' locomotives again were of the G-12 class, it being required to increase the bunker capacity of the tender while maintaining the original tender frame. This increase, from 6.4 to 11 tons, was achieved by suppressing the steam-motor and auxiliary-burner equipment. The tender tank is of the water-leg type, as in the previous locomotives. The blowers supplying the primary air are arranged on top of the tender tank at the rear end of the engine. The blower casing is cast solid with the turbine casing, which ensures sturdy construction. The turbine shaft, by means of a worm gear, drives a vertical shaft extending downward through the water tank, the latter shaft operating the two dust conveyor worms by a bevel and spur-wheel gear. The gearing reduction is about 1 to 30, the conveyor worms rotating at a maximum of 150 r.p.m. The worms are located in two trough-shaped castings forming the bottom of the bunker and affording perfect alignment of the worm bearings. The air current from the blowers encloses the trough in three-quarters of a circle and picks up the dust at the worm outlet, whence it is conveyed toward the burners through two pipe couplings having ball joints and stuffing boxes. The burners are again located below the firebox back plate. The ashpan casing is fitted with inlets for giving access to the secondary air. The size and number of these inlets depend on the type of coal used, one slot below the brick arch being quite sufficient for lignite. The brick arch extends inward to about one-half of the firebox length, thus producing an S-shaped flame. In order to remove such deposits as may form on the tube sheet owing to an occasional supply of inferior or too coarse-grained dust, an ash-blower is provided in the firebox back plate. It will be useful for cleaning the boiler in such cases and also can be operated while the locomotive is running if necessary. Otherwise the locomotives have not been modified as against the conventional G-12 class, there being only the addition of a steam connection at the dome for the turbine on the tender. Of course, the blast pipe was adjusted so as to produce sufficient draft for drawing the secondary air supply into the firebox, a pressure of 4.2 lb. per sq. in. of the exhaust steam in the blast pipe being the maximum required at top output.

The control of the engine is exceedingly simple. The fireman has but to regulate the supply of steam to the tender turbine by turning a single handwheel, thus varying the quantity of fuel and primary air. The ingress of secondary air is controlled by a valve in the ashpan. This clearly demonstrates the relief to the fireman as against grate-fired locomotives. The dust conveyor worms are clutched and declutched by two ratchet levers conveniently arranged on the fireman's side. The air and dust supply systems are again so interlocked as to make them foolproof; i.e., it is impossible to start the conveyor worms without first producing an air current to carry the dust into the firebox.

Careful investigations have been made by Stug with a view to ascertaining whether it would be advisable to

Table IV—Tests Made in the Mittelfeld Testing Plant on Hard Coal

Date	4–29–30	4–15–30	6–27–30	7–16–30	8–1–30	8–5–30	8–7–30
Kind of coal	Silesian coal		Ruhr coal				
Lower heating value, B.t.u. per lb.	12,184	12,184	13,605	13,605	13,618	13,618	13,618
Volatine constituents, per cent	29.9	29.9	21.1	21.1	20.08	20.08	20.08
Fuel consumed, lb. per hour	2,482	3,395	630.5	1,592	1,951	2,535	2,954
Firebox heat output, B.t.u. per cu. ft. per hour	1.42×10^5	1.94×10^5	0.402×10^3	1.01×10^5	1.25×10^5	1.62×10^5	1.89×10^5
Evaporation, lb. per hour	19,941	26,015	6,601	14,661	18,129	22,995	26,191
Temperature of feedwater, deg. F.	212	214	212	212	212	210	212
Coefficient of evaporation	8.04	7.66	10.45	9.22	9.29	9.08	.832
Evaporation of heating surface, lb. per sq. ft. per hour	9.59	12.52	3.18	7.05	8.73	11.07	12.6
Boiler pressure, lb. per sq. in.	193.4	193.4	192.0	197.7	197.7	197.7	196.2
Average temperature of superheated steam, deg. F.	595	649	satd. steam	561	530	571	601
Average temperature of flue gas in smokebox, deg. F.	583	651	435	523	529	564	577
Average CO_2 contents of flue gas, per cent	13.1	13.6	11.4	12.7	12.0	12.8	12.5
Temperature of primary air in burner, deg. F.	173	172	183	176	170	164	161
Boiler efficiency based on a loss of heat of 12 per cent	75.0	73.2	78.4	76.1	75.2	75.1	74.1
Free heating surface in firebox (not brick-lined), sq. ft.							131.6
Heating surface in tubes, sq. ft.							1945.1
Total heating surface, sq. ft.							2076.7
Firebox capacity, cu. ft.							211.9

$$\frac{\text{Free heating surface in firebox (sq. ft.)}}{\text{total heating surface (sq. ft)}} = \frac{131.6}{2076.7} = \frac{1}{15.8}$$

$$\frac{\text{Firebox capacity (cu. ft.)}}{\text{total heating surface (sq. ft.)}} = \frac{211.9}{2076.7} = \frac{1}{9.79}$$

grind the fuel on the tender. The result, however, was that at present serious difficulties would be experienced in trying to design a mill to combine light weight, reduced volume, economy and reliability to such an extent as would be required in view of the limited space on the tender and the considerable variation in locomotive output.

It is noteworthy that during the whole running period there was not a single case of self-ignition or spontaneous combustion. There is, however, every reason to believe that, even if such an occurrence should come to pass in the tender bin, there would be no danger, as the glowing dust could be blown into the firebox.

Caking of the fuel in the tender bin was not experienced. In order to counteract arching of the dust, some upturned whirling nozzles in the sloping sides of the bin were provided. It was, however, hardly necessary to resort to them.

In firing up a coal-dust-fired locomotive from cold, steam of 75 to 85 lb. per sq. in. pressure is taken either from a pipe line in the enginehouse or from another locomotive under steam, the connection being made through the steam-heating pipes of the locomotive. This will start the tender turbine and set the blower ring on the exhaust pipe of the engine to work, the dust and fuel mixture entering the firebox being ignited by a wood or cotton-waste fire. Once the steam pressure in the locomotive boiler has risen to about 80 lb., it will furnish the supply for further steam raising, and the outside source can be dispensed with. The time for thus steaming a pulverized-fuel burning locomotive is considerably shorter than in the case of a grate-fired locomotive.

It will be interesting to note that all of the auxiliary machines have acquitted themselves very well in nearly two years' road service. The conveyor screws were never clogged up. A fact deserving particular mention is that the holes in the burner plates were neither clogged nor worn by the impact of the dust and that the air cooling has been entirely sufficient as provided.

Experience with the brick lining was satisfactory, only little repair work being necessary.

While working safety was thus always on a high level, it may yet be permitted to inquire as to what happens if one of the worms or burners fails. In this case the locomotive can be operated at reduced performance on the other burner. The risk in this respect is, however, no greater than that of the two boiler-feed devices of a locomotive failing simultaneously. How seldom this happens is well known.

The Stug's research work has established that slack dust, too, has a bright outlook in Germany on account of the difference in price between lump coal and slack. This justifies a favorable forecast also in respect to locomotives fired with slack dust. This will be particularly appreciated for application to high-pressure locomotives, toward which there is a strong tendency, and which, on account of their small water spaces, make an easily adjustable fire control desirable.

4-6-4 Type Locomotives On the Canadian Pacific

(Continued from page 171)

the stoker engine. The suction line heater has a 3/8-in diameter pipe.

The locomotives are equipped with American multiple throttles. The connecting rod from the throttle-shaft connection to the lever in the cab is placed in the hand-rail along the right side of the boiler. The throttle lever is easy to operate and can be set to any notch on the quadrant with little effort. No compensating lever is used.

The valves are actuated by a Walschaert gear. This is designed with a short throw of the eccentric and with a long link. It has small working angles, the object of which is to secure an easy and smooth working valve motion. The engines are fitted with screw reverse gears.

One of the illustrations shows a class H1b locomotive under construction in the shop before the rods have been applied. The main drivers have not been painted and clearly show the counterbalance weights as they have been compensated previous to application. All driving wheels are carefully checked in the shops on a balance table so as to secure minimum variations in counterbalance weights. Cross counterbalancing is used in the main wheels, but is not considered necessary in the leading and trailing wheels. Forty per cent of the reciprocating weights are balanced, which is distributed over all the wheels.

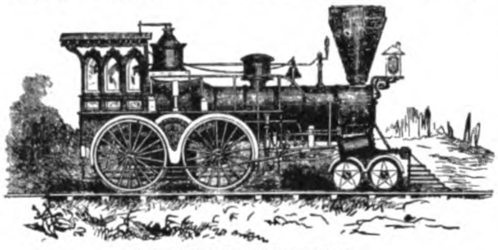
The engine truck is of Commonwealth design constant-resistance type. Its journals, as well as those of the tender trucks, are equipped with SKF roller bearings. The trailer truck is fitted with floating liners and one engine is fitted with SKF roller bearing trailer truck for experimental purposes.

The locomotives have Commonwealth cast-steel beds with the main cylinders and air reservoirs cast integral. The connection between the engine and tender is of the Franklin unit-drawbar type utilizing the railway company's standard laminated drawbars and also the Franklin special wedge type E-1 radial buffer, all of which were described in the March, 1929 issue of the *Railway Mechanical Engineer*, page 123.

* * *

RICHARD NORRIS & SON,

RICHARD NORRIS. HENRY L. NORRIS.



A Norris First-Class Passenger Engine.

PROPRIETORS OF NORRIS' LOCOMOTIVE WORKS,
PHILADELPHIA.
ESTABLISHED 1831.
17th street above Callowhill, embracing both sides of Three Squares.
ENGAGED EXCLUSIVELY IN THE MANUFACTURE OF LOCOMOTIVE STEAM ENGINES.

A Norris First-Class Freight Engine.

MANUFACTURE to order, Locomotives of any arrangement, weight, or capacity. In *design, material,* and *workmanship* the Locomotives produced at these Works are *equal to*, and *not excelled by any.* The iron used in construction *is all made on the spot,* from selected scraps, filed and faggotted under steam hammers, ensuring soundness and strength. The wheels are also made on the spot, from established quality Charcoal Cold Blast Iron, and of a form to ensure strength. The workshops are filled with the most approved tools, and a large force of experienced workmen. The proprietors apply their whole time and attention to their business, and may always be found during working hours at the Works and from their extensive facilities, with a larger extent of shops, and equipment of tools and machinery, than any other Works, they are enabled to meet demands for their work commensurate to their facilities which are fully equal to Three Complete Locomotives every six days. *Liberal terms* extended, and *work guaranteed.*

Every description of material for the renewal or repair of Locomotives furnished promptly. Constant supplies of Lowmoor and Bowling Tyre Bars always on hand, ready to bend, weld, and form to any diameter, so exact as to render turning out unnecessary. 41

Advertising typical examples of the locomotives builders art in the *American Railroad Journal* during 1855

Condensed Mechanical Data For Car Department Reference

Herein is described a pocket-size book comprised of blue-printed pages which contain condensed tabulations of car series and the repair parts most often called for—Detailed references of standard equipment and standard practices are also given to facilitate repairs and to expedite the movement of cars through large and small shops

By P. P. Barthelemy

IN the handling of car repairs, the lack of readily accessible information relative to the identity of a repair part or parts standard to any particular car is often a serious handicap and one which is frequently encountered. This applies chiefly to the more generally used items, such as couplers, coupler yokes, draft-gear parts, sill steps and truck repair parts, such as bolsters, side frames, arch bars, brake hangers, etc.

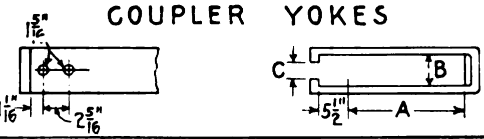
In the absence of a very intimate knowledge of detail standards or of readily available reference data, more or less extensive identification measurements must be made, or, where available, reference must be made to a usually cumbersome set of blue prints. At small repair points complete blue-print information is usually lacking. In either event there is an appreciable loss of time to the workmen, as well as to the supervisor, and possibly of service time to the car, which in the aggregate runs into a considerable monetary loss.

For home cars such losses may be almost entirely eliminated. In the case of foreign line cars, much of this is unavoidable, but if information relative to a

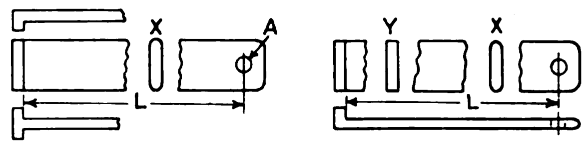
	KIND	LGTH./CAPY.	WT. CWT.	BUILT	BRK. CYL.	DRAFT GEAR	YOKE	FOLLOWER	COUPLER	DRAFT SPRINGS	BRK. SHFT.	HAND BRAKE	SIDE BEARING	TRUSS ROD	TR. RD. END	CENT. PIN	SILL STEP	TRUCK BOLSTER	SPG. PLK.	BRK. HGR.	BRK. BEAM	TRK. SPG.	ARCH BARS TOP	ARCH BARS BOT.	ARCH BARS TIE	BOT. ROD	SD. DOOR	END
3000-5999	B	40/80	424	SUF '25 & '27	10"	CAPD.G25	25	-	6/8-D	393-4	12'11"	PL	FR	1 1/8-8	1 3/8		2-3	฿	13"]	1	2T	343 6	43	44	45	2	฿ 5-6	W D
6000-7999	"	"	"	" '28	"	SESS. K4	"	16 2	"	601-2	"	"	"	" "	"		"	"	"	"	"	"	"	"	"	"	"	"
8000-8499	"	36/60	350	" '26	8	CARD.G25	"	-	"	393-4	11'6"	"	"	" 6	"		"	"	"	20	2C	" 4	152	153	154	"	5'4"	"
8900-8999	HOP B	40/80	439	SUF '29	10	CARD-SESS	25	16	6/8-D	393-4 601-2	12'11"	PL	FR	1 1/8-8	1 3/8		2-3	฿		1	2T	343 6	43	44	45	2	฿ 5-6	W D
9000-9999	B	"	437	" GN '25	"	CARD.G25	"	-	"	393-4	"	"	"	"	"		"	"	"	"	"	"	"	"	"	"	"	} -
10000-12897	"	.	348	฿'01,'02	8	BRAD 6/8	26	-	5/7-6 1/2 D	378-9	11'6"	"	"	"	"		1	"	"	"	"	"	"	"	"	"	"	W D
13000-17276	"	"	424	SUF '30	10	CARD G25	25	-	6/8-D	393-4	12'11"	"	"	"	"		2-3	"	"	"	"	"	"	"	"	"	"	"
17277-18762	"	"	387	฿'12]5[9"	"	WP 8/8	17	9	5/7-9 1/8 D	380-1	11'6"	"	"	"	"		1	"	"	"	"	"	"	"	"	"	"	"
22744-23493	"	"	428	WSCF '17 SUF '29	"	CARD-SESS	25	-	6/8-D	393-4 601-2	12'11"	"	"	"	"		2-3	"	PS	2	"	"	BETT CT 443			"	"	"
23494-24993	"	"	457	MT.V. '19	"	SESS K4	"	16 2	"	601-2	11'10"	"	WN	-	-		12	USS 1412	13]	3	2C	350-1 4	USS 1409			3	NFL 6'0"	} -
24994-25993	"	"	441	PUL. '23	"	CARD.G25	"	-	"	393-4	"	"	"	-	-		"	"	"	"	"	"	"	"		"	C332 6'0"	} -
31000-31499	B	40/100	482	GN '27	10	MIN.A79X	25	16 1	6/8-D		13'1"	PL	OO.T BARB	-	-		24	BSCCo B-592	13]	3	2C	350-1 4	DAL BSF 549			3	C-32 6'0"	} D
43000-43399	A	50/80	546	GN '27	10	CARD.G25	25	-	6/8-D	394-4	13'3"	PL	OO.T BARB	-	-		19	฿	13]	1	2T	343 6	43	44	45	2	C-50 10'0"	} D
43400-43499	"	"	"	"	"	"	"	-	"	"	"	"	"	-	-		"	"	"	"	"	"	"	"	"	"	"	} AU E.D.
43500-43899	"	50/100	559	GN '29	"	MIN.A79X	"	16 1	"		"	N.M.-H	"	-	-		"	ASF 764-2L	PS	3	2C	350-1 6	DAL ASF 7859			3	C-50 12'0"	} D
43900-43999	"	"	560	"	"	"	"	"	"		"	"	"	-	-		"	"	"	"	"	"		"		"	"	} AU E.D.
57600-57999	S	36/80	390	SUF '28	8	SESS.K4	25	16 2	6/8-D	601-2	11'6"	PL	FR	1 1/8 8	1 3/8		2-3	฿	13]	1	2T	343 6	43	44	45	2	฿	W & S
58000-58499	"	"	380	STEEL PUL '22	10	CARD.G25	"	-	"	393-4	"	"	"	-	-		2-3	"	"	4	2C	"	146	147	148	3	"	"
65000-65499	F-S	52/100	423	S.S. '28	10	CARD.G25	25	-	ROTOR 6/8-D	393-4		JMCo	OO-T BARB	-	-		12	ASF 7642-A	PS	3	2C	350-1 6	DAL 7859			3	-	-
69500-69999	LOG	43/100	385	S.S. '29	"	MIN.A22X	"	16 1	"			URECo	"	-	-		"	B592	"	3	"	"	DAL F547			"	-	-
77000-77249	G S	40/140	504	P.S. '27	"	CARD.G25	"	-	6/8-D	393-4	10'0"	MIN. LEVER	"	P.S. DUMP			8-9	D	"	"	"	350-1 7	DAL SSCo. 4206			"	-	-
85500-85800	O	22/150	447	CAST. SU7	"	CARD.G20	24	-	D 6/8-17 1/2	"		AJX-V	"	ENT PRIS DUMP			22	B-76	13]	6	ROYAL INTC	350-1 5	BSC F76			2	-	-
89000-89749	"	"	402	P.S. '23	"	"	"	-	"	"		MIN LEVER	"	P.S. DUMP			15	7118	PS	6	"	"	F78 BETT			"	-	-

Fig. 1—A sample double page of the pocket-size reference book which gives condensed data on system car series with detailed identification references to the various items indicated by the headings

COUPLER YOKES

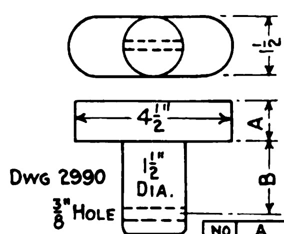


NO.	DWG.	SIZE	A	B	C	FILLER BLOCK	DRAFT G
1	2125	1¼x5	22¾	9½	6½	F1092	WP 8x8
2	2126	"	26¾	8½	"	F1714-5"	MINER 8x8
3	2127	"	23⅞	9⅛	9⅛		REPB.
10	2130	1¼x4	20½	6½	6½		WP 5x6x8
11	2131	1¼x5	22¾	7¾	"		WP 6x6x8
14	2132	"	11¾	6½	"		TWIN 6x8
17	2134	"	22¾	9½	9⅛		WP 8x8
18	2139	"	27	9⅛	"	F2069-5"	MINER 8x8
19	"	1x4	26	6½	6½	F1713-4"	" TAND.
20	"	"	23	"	"	F1712-2"	" "
21	"	"	24	"	"	" "	" "
22	"	1x5	27	"	"	F2022-5"	" "
23	2140	1¼x5	24⅝	9⅛	9⅛	P2573-EX. REF.	" FRICT.
24	2305	C.S.	17⅝	9¼	9¼	BUCKEYE Y-73	CARD G20
25	2312	"	24¾	"	"	ARA " Y-61	ARA
26	2808	1¼x5	20½	6½	6½		BRADFORD
27	27229	"	18½	9⅛	9⅛		CARD G11
28	4056	1¼x4	10¾	6½	6½	P2340	PASS
29	5428	C.S.	25⅝	9⅛	9⅛	DINERS-1030-41	"
30	4846	1¼x5	24⅝	"	"	10 DINERS P2495	"
31	4871	"	"	"	"	SUT. PASS	



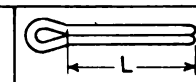
NO.	L (NORMAL)	SECTION	SIZE		A
1	19½	X	1½x6	ARA-GEN. USE	1 9/16
2	18	X	1¼x5	86500-89749	"
3	16	X	1⅛x5	FARLOW	"
4	19	X	"	"	"
5	21	X	"	"	1 3/16
6	16	Y	1⅛x6	"	1 9/16
7	19	Y	"	"	"
8	21	Y	"	"	1 3/16
9	19½	Y	"	" PASS	"
10	22	Y	"	" "	"
11	21½	X	1⅛x5	" "	"
12	22	X	"	" "	"
13	23	Y	1½x5	BRAD. SP.	"

DRFT. KEY RET.



NO.	A	B	
1	1"	2 1/16	ARA
2	3/4"	1 5/16	

COTTERS



L	
3/16 x 1	COUP. TOG
" x 1½	RELEASE RODS
¼ x 1¼	UNCOP. LEVER
" x 2	BRK. SH. D.L.G.D.
" x 3	STL. ORE
5/16 x 2	BRAKE RIG.
" x 3½	DP. SHAFT H. & DT.
⅜ x 3	QUEEN POSTS
" x 5	CARDWELL ROD
½ x 3	UNCOP. L. BRKT.
" x 4	ORE CARS
⅝ x 2½	DRAFT KEYS
¾ x "	" "
⅜ x 2	BRAKE RIG.

Fig. 2—A double page of the reference book showing the tabulation of coupler yokes, coupler draft keys and cotter keys

similar part, used on home cars, is available for quick reference, a home standard can often be found that will fit properly. When this can be done the excessive cost of hand manufacture is obviated, a general saving on the job is effected, and the movement of the car is expedited.

In order to surmount these difficulties by providing readily accessible detail information, the general foreman of a large western car repair shop compiled a condensed tabulation of system car series, showing thereon identification numbers for the repair parts most frequently called for. This was made up in a pocket-size, blue-printed booklet, and issued to foremen, sub-foremen, inspectors, material men, store men, and to any others to whom the information would be helpful. The plan worked out so well that later the amount of information included was materially increased and the books were sent to all car-repair points and issued to the various employees to whom the contained information would be useful.

This book has also proved to be of considerable value to higher railroad officers. The book now contains 36 pages, 10 of which cover car series, the balance being tabulated details.

For convenience in connection with a data book of this kind, as well as for other record purposes, the various fabricated parts are given individual numbers which are shown on detail drawings of those parts. Sample pages from this book, which is 4 in. by 6 in. in size, are shown by the drawings.

Fig. 1 shows a sample double page which covers the data on a system house-car series with detailed identification references to the various items indicated by the headings. This page is made up from groups of series taken from several pages of the book. The car series are arranged in numerical sequence with the series divisions made on mechanical construction lines. Following the series is a symbol to indicate the kind of cars, after which is given the nominal length and capacity, the average weight, and the builder and date built; all this information being of a general and useful character. Following these come detail references, which are, as far as possible, grouped according to the relation to each other, such as draft gears, coupler yokes, draft-gear followers, couplers and draft springs. Truck details shown are also grouped, all making for quick and convenient reference.

Double-ruled, vertical lines are used to divide the groupings and to serve as a guide to the eye in following the items down the columns. A light, horizontal guide line to each few items is used, it being less confusing than a line for each item, or no ruling at all. Ditto marks are purposely used as they indicate more clearly to the eye the fact that the items are alike than would be the case with a repetition of figures or symbols. This method also has an educational value in that such similarities stand out more prominently, and therefore will be more readily memorized and, since a thorough knowledge of details is essential, it leads to a higher degree of efficiency. With the same end in mind, like detail dimensions of similar parts shown on tabulation pages are also dittoed.

While the headings illustrated in Fig. 1 are those pertaining to the class of cars shown thereon, appropriate

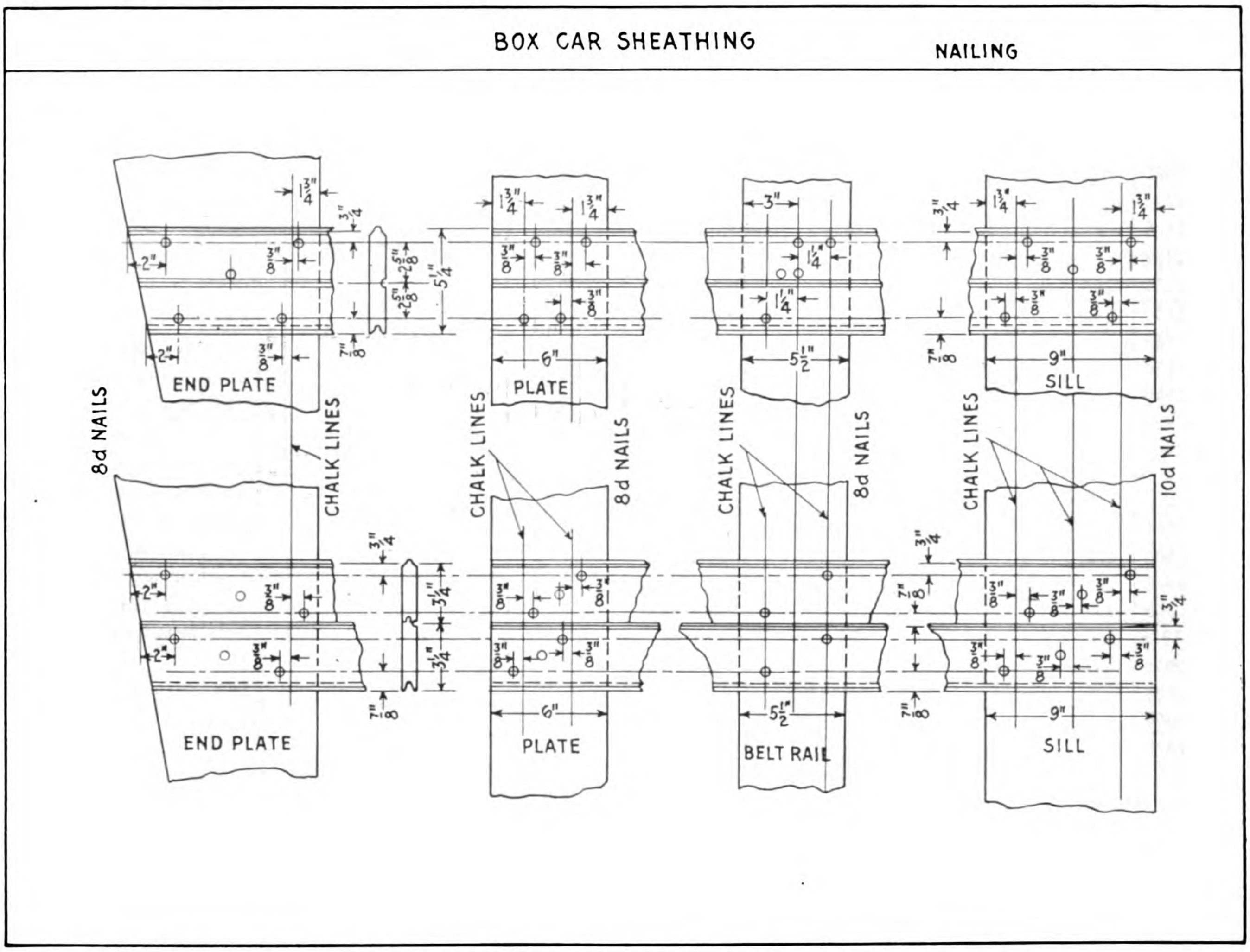


Fig. 3—A page from the book which shows in detail the method for nailing side sheathing on box cars

headings are used on other pages covering other types of cars to include as many details of the cars as possible. Vacant lines are left on different pages where a large block of vacant numbers between car series occurs, so that when such vacant series are filled out, they may be entered at the proper place in the book to maintain the scheme of keeping the book orderly and the series in numerical sequence.

Other pages in the book tabulate in a similar manner the various parts of special cars, such as cabooses, tank cars, dump cars and other types of work equipment. Only those occurring in appreciable groups are shown, as the inclusion of all work cars would make a too cumbersome record for the purpose for which the book is primarily intended.

Tabulation of Coupler Equipment

Fig. 2 shows a tabulation of coupler yokes, coupler draft keys, and cotter keys. The sketch at the top shows the location and size of coupler-yoke rivet holes, while in the tabulation all the essential identification dimensions are given with a symbol indication as to the kind of draft gear with which each is used. Dimension *A*, it will be noted, is the draft-gear opening in the yoke. That dimension and the width of the opening are the most commonly used identification dimensions, but with the details indicated by the sketch, any other identification may be quickly and accurately made.

Coupler draft-key dimensions are shown similarly, the table including A.R.A. standard, Farlow, and other special sizes, with tabulated dimensions and symbols to indicate rounded or flat edges. The tabulation of cotter keys is included as a guide to proper sizes for those in most general use and as an aid to standardization.

Another page in the book tabulates information concerning arch bars. At the top of this page is a sketch, the dimensions on which are represented by various letters. The dimensions of various sizes of arch bars, for which the letters stand, are then given in the tabulation. The bar numbers are grouped in sets by light horizontal lines A mechanic with a general knowledge of arch-bar construction could fabricate, in an emergency, an arch bar from the ruling dimensions given on this page. In case an arch bar is required for a foreign car, by taking ruling dimensions, it can be ascertained, by reference to the tabulated material, if there is a system bar that will fit. This is a frequent occurrence and in many instances much time and considerable money can be saved. This is obvious, since the home arch bar is machine-made on a quantity production basis, whereas an individual bar would be hand-made. Having the proper bar at hand to facilitate repairs may also result in saving a day's service to the car.

Tabulation of brake-beam hangers, included on another page, shows all the brake-beam hangers used on the system in full detail. They are numbered according to the various styles used on the road and opposite each number is shown the style of brake beam, its length, the size of the pin hole and the size of the shank.

Another page in the book is illustrated in Fig. 3, which shows the detail method for nailing side sheathing on box cars. This shows the proper location for each nail, as well as the size of the nail and the number to be used in each location. Naturally, the actual nail loca-

tion is approximate, but this sketch gives a general outline for guidance in doing this work.

A diagram similar to the one shown in Fig. 3 is used on another page to show the proper method to be used for nailing car decking. For further convenience of the mechanics large prints of these nailing pages are framed and posted at different points in the shop.

Tabulation of Truck Side Frames and Bolsters

A full page is included in the book which shows the car series, in numerical order, which are equipped with cast-steel truck side frames, or cast-steel truck bolsters. This page shows the builder's numbers cast on these parts, the nominal capacity of car, and the section and type of side frame used. On the opposite page are grouped interchangeable cast-steel truck bolsters and truck side frames which, while carrying different builder's numbers are of like construction. This information is of importance to both the mechanical department in making replacements and to the stores department in keeping down stock by eliminating duplications.

Brake levers are also tabulated in the book, the tabulation consisting of car series arranged in numerical sequence, with headings for the different levers, and a sub-head showing lever numbers and hole spacings. The numbers for the levers which are tabulated are those used for the same lever on detailed drawings. As added information, the size of brake cylinders is shown in the last column on this page. These sheets are not generally included in the data book, being issued only to those requiring them in connection with their assigned duties.

Numbers are extensively used for various detail items. Such a system is of general convenience in that it simplifies stock records and facilitates reference study by mechanical-department men. Therefore, in making drawings of details of which several kinds are used—brake beam hangers, for example—it is the practice, when feasible, to group these on a general drawing, giving each an identification number. This system has been of particular advantage in the preparation of this book.

The general use of the book has not only served to help standardize and expedite repair work, but has had an inestimable educational value. Its convenience and ready accessibility are inducements for its study and, as a consequence, those responsible for shop production, as well as inspectors, mechanics, and others, have learned a great deal regarding car series and car construction.

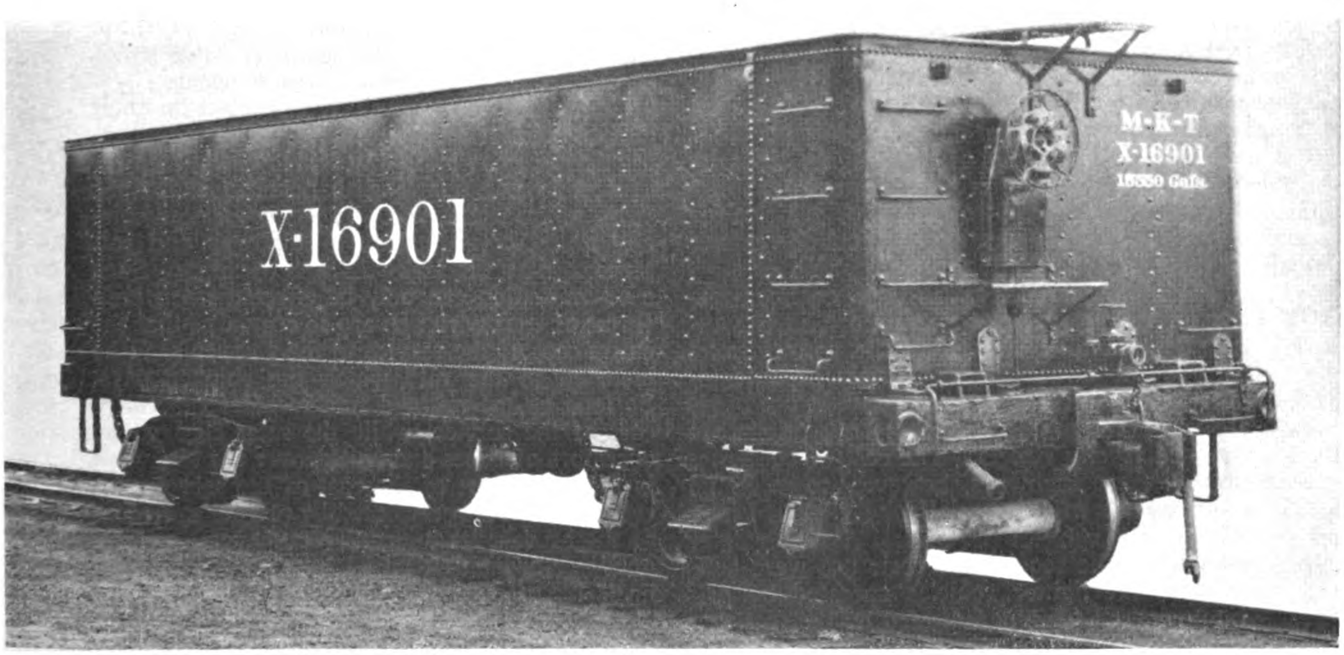
Draft springs are also tabulated in the book, the number and size being shown in headings with the number of springs per draft gear shown in appropriate columns opposite side items indicating draft gears. For further convenience, draft follower-plate and coupler-yoke numbers are shown on this page. Truck springs are likewise tabulated, and a set of small diagrams is included, indicating groupings of the A.R.A. truck spring.

Facilitating Repairs on Cars Set Out

The data contained in this book are of especial value in case it becomes necessary to send men out on the line to make emergency repairs to a system car which has been set out. Given the car number and defect, correct information may be gained at once by referring to data book, and proper material taken along by men for making repairs. Since correct material is at hand, such repairs are of a permanent character, instead of a makeshift, temporary arrangement to get the car to the next repair point. Thus the movement of the car has been greatly expedited, the cost of repairs has been held down to a minimum, and the accident with its attendant added cost for rip-tracking the car for proper repairs is obviated.

A similar data book of the same size as that covering freight cars has been prepared for passenger cars. In this instance the individual car numbers are shown in numerical order and for convenience the car number is shown at the front of first page, as well as at the back of the opposite page. Each book referring to freight- and passenger-car data is furnished with pages which give the key to the symbols and abbreviations that are used on the various pages.

* * *



M-K-T auxiliary tender for eliminating water stops—The tank is made of 5/16-in. and 3/8-in. copper-bearing steel plate, is set on a Commonwealth cast-steel underframe and has a light weight of 84,000 lb.—It is equipped with independent brake cylinders on each truck, a running board, two man holes, a tank hose connection to the tender tank or direct to the right hand injector and has a 15,550 gal. capacity—The car illustrated is one of five now in service

A Fight For Your Jobs

THE proposals of the railroad executives for effecting a more equitable status of regulation as between themselves and competing forms of transportation have led spokesmen of the automotive industry to assume that the entire industry is under attack. In public statements they are trying to make it appear that the position of the railroads with respect to competition which they are meeting from motor vehicles operated "for hire or profit using the highways" is against the interests of the private automobile owner, operators of buses within as well as between cities, owners of trucks who operate them privately in the conduct of their business, and commercial truck operators whose business is strictly intra-city, as well as those who operate on inter-city routes. They are in particularly violent opposition to the railroads' proposal that there should be "adequate provision for privilege or license fee imposed on all motor vehicles for hire or profit, using highways so as properly to participate in construction and maintenance costs of highways."

In round numbers some twenty-six million motor vehicles are registered in the United States. Of this total, about 3,240,000 (1929 registration) are motor trucks, over 2,900,000 of which are rated at two tons or less carrying capacity. Few, if any, of these small trucks are operated on highways for hire or profit. Trucks so operated are confined to some part of the 250,000 vehicles, ranging from two and one-half to over five tons in capacity. There are some 92,500 buses, of which only about 24,000 are in common-carrier service on the highways.

Assuming that all of the higher capacity trucks are in service on the highways "for hire or profit," there are 94 other motor vehicles for each bus or truck operating as a common carrier or for hire over the highways.

The highways over which these common-carrier or for-hire vehicles operate are, in the aggregate, provided largely by the special taxes paid by the owners and operators of automobiles, buses and trucks who either do not operate for profit or hire or whose operations are confined to city streets. The cost of construction of these highways, however, to meet the requirements of these relatively few but heavy commercial vehicles is several times greater than would be required if their use were confined to the lighter vehicles operated by private owners. This is indicated by the fact that in 1929 the average expenditure for construction of state highways was over $17,000 per mile of highway built during that year, whereas the average expenditure for local roads amounted to less than $6,000 per mile of local road built during that year. The expenditure for maintenance of state highways per mile in service at the end of the year was $550, while the expenditure per mile of local highway was $95.

The owner of a private automobile who uses his car on city streets for six days a week with an occasional Sunday trip over the state highways, as well as the owners of trucks and buses operated exclusively over city streets, is contributing heavily for the construction and maintenance of the expensive state highways financed by the revenue from license fees and gasoline taxes. Many of these highways have been built at a cost per mile comparable with that required to build and equip a steam railroad in order to meet the requirements of about one per cent of all motor vehicles in operation. The farmer who operates his truck over the local highways built and maintained from county revenues pays for these highways largely in his general property tax at the same time that he contributes to the construction of the expensive state highways by his gasoline and license taxes.

In asking that motor vehicles operating "for hire or for profit using the highways" be required to participate properly in the construction and maintenance costs of the highways, the railroads are certainly acting in the interests of the vast majority of motor vehicle owners.

Commercial motor vehicle operators in their attacks upon the railroads' program for adequate regulation of highway competition claim that the railroads are attempting to penalize a cheaper form of transportation. It is for an economically sound co-ordination of highway and rail services that the railroads are working. Such a co-ordination can only be effected when both forms of transportation are so regulated that the entire cost of the service to the shipper shall be included in the rate which the shipper pays. So long as the railroad rate includes the entire cost of the service, while the rates charged by operators of buses and trucks over the highways include only part of the cost of the service, the rest of which is contributed by private operators of motor vehicles and other taxpayers, an economic co-ordination in the interests of the public is impossible.

Help make these facts clear in your community.

EDITORIALS

Scale Your Sand Boxes

Sandpipes stopped up with scale and lumps of sand are evils which have been with the railroads for many years but are still problems which concern engine crews and enginehouse forces. The sandbox should not be neglected when a locomotive is on the drop pit or in the shop for class repairs. Scale can be prevented from getting into the sandpipes if the sand is removed at such times and the box is sealed on the inside by lightly hammering it so that all the loose scale can be removed. Careful inspection of the sandbox and ascertaining whether or not the sanders function properly will go a long way toward reducing the number of delays on the road.

Is the Use of Free Oil Economical?

Appearing elsewhere in this issue is an article by a chief-car inspector in which he condemns the wholesale use of free oil as practiced by a number of roads in lubricating car journals when passing over humps and through dispatchment yards. This article was prepared at the request of the editor in response to inquiries from a number of readers of the *Railway Mechanical Engineer*. There is no question but that there is considerable waste of oil when the lubricant is poured into the journal box while the car is in motion over a hump. Oil on the end of the journal, on the sides of the box or seeping out of the back of the box is not doing its job. Packing should be re-adjusted in the box after new oil has been added. Still, the big job is to get the cars over the road. Sometimes theoretical ideas have to be modified to meet the demands of actual practice. The question to be answered is: Do the results justify the waste of free oil? We would like to hear from others on this subject.

Economy in Sand-Blasting

A notable and desirable increase in the amount of sand-blasting done on both locomotive and car equipment has taken place within the last few years, resulting in numerous economies and advantages to the railroads. Principal among these may be mentioned the saving in labor, as sand-blasting provides one of the easiest and most rapid means of cleaning metal surfaces. Moreover, the sand blast does a thorough job of cutting away dirt and paint, particularly in corners and irregular places where manual methods would be ineffective unless carried out with the most painstaking care.

Many railroad sand-blasting operations are carried on out of doors, although sand blast sheds are being provided to an increasing extent to permit carrying on the work under all weather conditions. The equipment needed is simple and relatively inexpensive to install, comprising primarily a sand storage bin, vibrator or cleaner, dryer, air and sand mixing tank, syphon connection to the shop air line, rubber hose lines and nozzle pipes. Among the locomotive parts most commonly sand-blasted are cylinders, frames, boilers (inside and out), and motion-work parts, the purpose being to remove rust and scale and permit a thorough inspection for defective material and cracks. Jackets are also sand-blasted at some shops, as well as the exteriors of locomotive tanks, to secure a smooth, scale-free surface, preparatory to repainting and varnishing. Steel passenger cars are sand-blasted for the same purpose, and a limited number of railroads are sand-blasting steel freight cars with good results. The idea that any kind of work, including careless painting, is good enough for a freight car is altogether too prevalent, and, since corrosion is admittedly the greatest enemy of steel equipment of all kinds, the relatively small additional expenditure for sand-blasting steel freight cars, in order that a protective coating of durable paint can be applied directly to the original metal instead of over a layer of rust or mill scale, may well prove a wise investment.

A good quality of cutting sand is required for the most efficient operation in sand-blasting, but experience has shown that this can be worked back into the sanding system and re-used several times before the cutting qualities are lost. The cost, from this point of view, therefore, is minimized. Three months' life, or more, may be expected from good rubber hose used in sand-blasting service, so that this item of expense is not prohibitive, considering the benefits derived. Pipe nozzles cut out much more rapidly, often lasting only a few hours, but they are usually made of short sections of scrap ½-in. pipe and, therefore, cost little. The indications are that a still more extensive use of sand-blasting operations at many railroad shops would prove worth while from the point of view of economy and better workmanship.

Faster Speeds in Railroad Service

The idea of travelling at a speed of 100 miles an hour invariably stimulates the imagination. We think of airplanes and racing automobiles along Daytona Beach. Writers of fiction and hair-breadth-escape stories frequently picture the hero as dashing away at 100 miles an hour with the beautiful damsel in his monoplane or sport-model roadster to be married and live happily ever after. If the setting of the romance requires escape on a locomotive with the hero at the throttle, we usually read that the engine was swinging around the curves at the terrific speed of 60 miles an hour.

The railroads have made as much progress with respect to speed as have other forms of transportation. Only they have not done so much bragging about it. The "Flying Scotsman" on the London & North Eastern in England must reach 100 miles an hour during certain parts of its run to maintain its schedule. This is not a new development but a passenger-train operation which has been in effect for several years.

Progress with respect to locomotive speeds has also been making considerable headway on this continent. Published elsewhere in this issue, is a report on the performance of the Canadian Pacific 4-6-4 type locomotives which frequently operate at average speeds of from 90 to 95 miles an hour. These locomotives are capable of

being operated at and undoubtedly do reach considerably higher speeds. There are several railroads on this continent on which passenger trains operating over extended runs have attained speeds of 120 miles an hour.

The attainment of such speeds must not only be credited to the designers and builders of locomotives but also to the engineers who are responsible for the development and maintenance of road bed, track and signals. That such speeds may be hazardous to the travelling public is largely a psychological phenomenon. The technical problems of safety and comfortable riding are practically solved.

White Elephants In the Railway Shop

Modern production methods employed in highly specialized industries are applicable to a certain degree in railway shops of roads using modern power and rolling stock. The degree to which the methods can be employed depend upon the size of the shop and the demand for the continuous repetition of one or more jobs in exactly the same manner. Shop schedules for locomotives and cars have been carefully scrutinized and have been reduced to a point where a large percentage of the slack has been removed from the human side of the problem. This is especially true during the present critical condition facing the railroads which are now operating trains and maintaining equipment with a greatly reduced personnel.

The problem of reducing shop schedules and speeding maintenance operation can be alleviated by the installation of modern shop machinery and equipment. Many railroads have adopted a conservative policy towards the use of specialized equipment and machines for grinding bearings, crank pins and bushings and automatic lathes for turning tapered frame bolts, portable machines for facing pedestal-jaw faces and similar machines. The adoption of modern equipment for re-conditioning locomotive and car parts not only facilitates the speeding up of repairs, but also increases the life of the repaired equipment after it has been replaced in service. Longer service life of locomotives and cars is being assured by many machine tool builders who have brought out equipment for producing highly accurate work.

With the present day demand for speed in the railway shop the fact remains that production must be increased without increasing the production per man-hour. There remains the one factor of reducing machine time for repairing the various locomotive parts and appurtenances.

The continued use of machines and equipment which are costly to maintain and which are not capable of producing in proportion to their maintenance cost, increases shop costs and hampers the output of other machines directly in the production line. They have been pertinently characterized as "white elephants."

White elephants in the railroad shop are familiar to all who are acquainted with railroad shop production methods. They have champions in the railroad shop who maintain that what little work is completed on such machines warrants their continued use, maintaining further that a new machine bought to eliminate the old one would probably be idle a portion of the time. Little thought is given to the fact that white elephants can only be used for the less precise classes of work which could better be done on new equipment that would increase its service life. And while the obsolete tool can only be used for a very limited classification of work, the new equipment can be utilized for all of the classes of work completed on the old machine, and also for others which will keep it in continuous operation.

The existence of white elephants is indisputable, but they are not always easily distinquished. Search for them and eliminate them.

Car Men Help Reduce Transfers

A notable reduction has been achieved by the railways generally in the number of transfers of loaded cars, received in interchange but unfitted to move to destination because of improper loading or serious defects in the cars, themselves. The average cost of transferring a load of freight from one car to another is estimated to be approximately $25 a car, exclusive of damage claims. When it is considered that only a few years ago the cars transferred annually at almost any of the major interchange points were numbered in the thousands, the economy and savings represented by present-day performance are striking.

Take, for example, the almost phenomenal reduction in transfers of cars passing through the Chicago district. Records of the Chicago Car Interchange Bureau, as shown in the brief accompanying summary table, indicate that the number of transferred cars was reduced from 11,938, in 1924, to 805, in 1930. This was a total reduction of 93.2 per cent in a period of seven years. The most marked reduction in any one year occurred in 1926, when 57.8 per cent fewer cars were transferred than in 1925. In many respects, however, the reduction of 37.6 per cent, in 1930, over 1929, represented an even more striking performance, since the number of cars transferred in 1929 had already been reduced to what many considered a minimum figure. On the basis of $25 transfer cost per car, the approximate saving, represented by the 1930 performance at Chicago as compared to that of 1924, was $278,325.

It may be said that fewer cars were interchanged during 1930 than in the previous year and that this automatically assisted in making a good showing as regards cars transferred. It is true that the cars interchanged at the Chicago district in 1930, as compared to 1929, were reduced probably about 13.4 per cent, or the same as the reduction in revenue car loading throughout the country at large, but the reduction in cars transferred was 37.6 per cent.

Seven-Year Record of Car Transfers at Chicago

Year	Number of cars transferred	Percentage reduction over previous year	Approximate total cost of transfers*	Approximate saving compared with 1924
1924	11,938	...	$298,450	......
1925	7,253	39.2	181,325	$117,125
1926	3,047	57.8	76,175	222,275
1927	1,775	41.8	44,370	254,080
1928	1,421	19.9	35,525	262,925
1929	1,289	9.3	32,225	266,225
1930	805	37.6	20,125	278,325

* Assuming an average cost of $25 per car, exclusive of claims.

The reduction in transfers at Chicago and other interchange points represents a greater accomplishment than indicated by the figures because car conditions are far from being entirely satisfactory. Deferred maintenance and the failure, in many cases, to select suitable cars for loading, due to no small extent to the drastic and forced reduction of inspection crews, have resulted in many unfit cars passing to shippers for loading. There is some evidence that, too often, trunk line carriers are not doing all that they can to prevent the delivery of these loaded bad order cars to connecting lines and, while this pertains to railroad-owned cars, it is particularly notice-

able in the case of privately owned cars, accepted for movement by the carriers in spite of the fact that they are not in the necessary physical condition to meet the requirements of modern high-speed operation. These cars are, no doubt, accepted for movement under the threat of traffic diversion, and the most effective remedy is the concerted action of the carriers to reject such cars, a result more easily talked about than achieved under present highly-competitive conditions.

That the number of cars requiring transfer would be greatly increased, except for the ingenious, earnest and strenuous efforts of car department supervisors to make repairs under load, cannot be doubted, and efforts along this line should be redoubled. It is also the duty of car supervisors to miss no opportunity to show their superior officers the false economy of excessively reducing car inspection and light-repair forces and then paying out what has been saved for transfers, with all that they mean in the way of train delay, operating expense and damage claims, not to mention dissatisfied shippers.

The Chill-Worn Wheel Defect

The only remaining judgment wheel defect with which the car inspector has to contend is the worn-through chill. If the wheel wears through the chilled metal of the tread it is a manufacturer's defect provided it occurs during the life of the guarantee. However, many inspectors place themselves in a position open to criticism by condemning wheels for chill-worn spots which in reality are slid-flat spots and, therefore, not owner's responsibility. In the latter instance the age of the wheel will occasionally indicate that it is not worn through the chilled metal.

Although the mottled grey-iron appearance of the worn-through portion of the tread indicates a chill-worn wheel, it does not always certify that the defect exists. A flat spot or depression is one indication used by inspectors in condemning this wheel, while another is to attempt to chip the worn-through spot with a cold chisel. The chill-worn wheel has some of the characteristics of a slid-flat wheel, especially in the fact that it sounds like one as it passes over the rail. Many inspectors, hearing the wheel bumping over the rail, will note the car and look for a slid-flat wheel when inspecting it.

The chill-worn wheel is characterized by an out-of-round condition which sets up excessive vibration in the truck, which results in the loosening of the truck parts. The continued vibration of the truck after these parts become loose will cause them to wear excessively until they become bright or shiney. This is true of column bolts, tie-strap rivets, journal box lids and, in the case of a one-piece side frame, the brake-hanger bolt holes and the spring-plank and truck-spring seats. The worn condition of these parts, when detected by the inspector should receive his closest scrutiny for the cause which in many instances will be the chill-worn wheel.

This defect, if not promptly discovered and remedied, will flatten rapidly and will often result in the breaking of the wheel rim, causing a derailment. Being a judgment defect, everyone concerned with the handling of wheels should make a careful study of it, the conditions under which it occurs, and its detection. Any systematic educational program for car inspectors should provide complete information to enable him to detect chill-worn wheels and to distinguish between those which are chill-worn and those which just appear to have this defect.

NEW BOOKS

Essays of a Locomotive Man. *By E. A. Phillipson. Stiff board binding, 5½ in. by 9 in., 143 pages, illustrated. Published by the Locomotive Publishing Company, 3, Amen Corner, E. C. 4, London, England.*

The book is comprised of 35 short essays of locomotive design, operation, and maintenance, each essay being a chapter. Subjects discussed include: Lubrication; Boiler Feeding and Superheating; Standardization; Steam Distribution; The Rivals of the Steam Locomotive; Shunting Methods and Costs, and Periodic Examinations.

Views and Reviews of the Hot-Box Situation. *By J. C. Stewart, Car Inspector, 123 North Belmont, Indianapolis, Ind. Cardboard binding, 4½ in. by 6 in., 65 pages. Published by Trade Educational Bureau, Brotherhood of Railway Carmen, 2275 South Lincoln Avenue, Denver, Colo. Price 50 cents.*

A small informative book which deals with the hot-box situation. In it are advanced the reasons for hot boxes and suggested remedies. The author has dealt with the subject in the language and style of the car man, treating every phase from the preparation of the packing to the finished packed journal. The book contains illustrations ranging from journal boxes, tools, etc., to apparatus used in reclamation plants.

Second World Power Conference, Berlin 1930. *Bound in cloth, 6½ in. by 9½ in., 264 pages, non-illustrated. Published by VDI-Verlag G.M.B.H., Berlin, NW 7, Germany.*

This volume is one of a set of publications reporting the technical sessions of the Second World Power Conference which was held in Berlin, June 16-25, 1930, inclusive. It contains brief abstracts of all the papers which were presented during the conference which are arranged under 34 different heads. Some of these group heads are as follows: Construction and Operation of Large Power Plants, which section contains nine papers; a section on Steam Turbines, Gas Turbines and Reciprocating Steam Engines, under which it grouped a total of 13 papers; and a section entitled "Stationary Internal Combustion Engines and Research Work in this Connection," under which are grouped abstracts of 11 papers.

Index to A.S.T.M. Standards and Tentative Standards. *Issued by the American Society for Testing Materials, 1315 Spruce Street, Philadelphia, Pa. 114 pages, 6 in. by 9 in. Paper bound.*

This pamphlet constitutes a combined index to all A.S.T.M standards and tentative standards in effect as of September, 1930. The index is designed to be of service to those familiar with the society's standards in locating any specification or method of test in the bound publications in which it appears or to those interested in ascertaining if the society has issued any standards on a specific subject. It contains a complete list of the 427 standards and 155 tentative standards which appear in the 1930 A.S.T.M. Year Book and in both parts of the 1930 Book of Standards. A price list gives the prices of the bound publications in which the standards and tentative standards appear and the prices of standards in separate pamphlet form.

THE READER'S PAGE

Air Jammer Referred To Case No. 1666

To the Editor:

Again we have our old friend *Railway Mechanical Engineer,* March issue on hand, and as usual have read it from front cover to back. I have some criticism to offer on one subject; namely, "Dirty and Inoperative—Why?" on page 146 by "An Old-Time Air Jammer." Why does he want all the details on a repair bill when the word "Inoperative" is sufficient?

I want to refer him to Arbitration Case No. 1666 and to Interchange Rules 9 and 60; "Air brakes cleaned, within date account, inoperative—Unnecessary to specify why inoperative."

A Car Foreman.

Thirteen Thousand Dollars for Brooms

To the Editor:

In these days when everybody is trying to make the dollar go as far as possible, a person checks up all sources of expenditure—even brooms.

We have found that the ordinary household broom is a rather wasteful article as its life is very short and it is an inefficient tool. A good hair brush lasts considerably longer, does a better job, and a man can cover a considerably larger area in a given time.

Has any railroad or factory made a detailed study of what constitutes the best broom for factory or shop use? This is a comparatively small item, but the railroad with which the writer is connected spends about $13,000 for brooms in the course of one year.

An Economist.

On the Packing of Journal Boxes

To the Editor:

Does everyone follow the rule and pack journal boxes in strict adherence to the sketch shown on page 92 of the 1931 book of Interchange Rules? During the past year our road experienced considerable difficulty with the hot-box problem and discovered that a large percentage of them was caused by overpacking. We found that the packer was desirous of being on the safe side and overfilled the box, which, in our opinion, is one of the causes of waste grabs. I note from the records of an eastern railway club meeting that it is the opinion of one of its members that, if a box is packed with a good grade of wool yarn with long strands, the box fills up after the car has moved a very short distance with the result that the same condition of overpacking boxes is present. On the other hand, it is stated that if a grade of packing with short strands is used, this condition does not exist. I have been wondering to what extent this is true, not having encountered any condition similar to it.

In the same proceedings I note one member of the club advocates that when changing wheels, boxes or truck frames the old packing can be re-used if it is in a fair condition, provided the box has been packed recently. What of the grit and dirt which is liable to be in the bucket in which the packing is placed when pulled from the box? What of the dirt and cinders liable to accumulate on the top of the packing while the wheels are being changed, or the boxes or truck frames are being replaced, To use new packing, the road only loses the cost of renovating. It is peculiar indeed that any car department officer should advocate the re-use of old packing, especially after it has been allowed to stand in proximity to the rip track where it is liable to collect dirt, cinders and other gritty substances from innumerable sources.

Car Inspector.

Three Questions On A.R.A. Rule 66

To the Editor:

A foreign car on the handling road runs a hot journal. After an inspection is made the packing is found dry, or with insufficient oil properly to lubricate the journals. The car is in date according to the stenciling. Can joint evidence be secured, the boxes re-packed and the owner billed for the re-packing?

Can the receiving road reject a car for, "It being the inspectors conclusion there is not sufficient oil in the journal-box packing and car is liable to run hot journals with serious results," regardless of last date packed?

A car comes to its home road. The journal boxes have been re-packed by a foreign road within the past 60 days according to the stenciling on the car. The inspector inspects the car and makes out joint evidence "account dope does not meet the specifications," or "does not have sufficient oil in the dope." The car is moved to the owner's repair track and is re-packed and stenciled. A bill is made out against the road that re-packed the car last, using the joint evidence certificate. Can the owners collect?

A Subscriber.

A.R.A. Rule 17

To the Editor:

J. A. Garner asked a question relative to the application of 9⅛-in. butt couplers, which appeared in the February issue. The question was answered in March, but I should like to comment further on the subject.

There is no A.R.A. standard 8½-in. butt coupler and the application of a coupler with a 9⅛-in. butt is justified by paragraph *a* of Rule 17 which provides that A.R.A standard may be applied in place of non-standard material.

Why a 5-in. by 5-in. shank coupler with a 9⅛-in. butt and Type D head "does not meet these requirements," as stated in the answer in the March issue, is not quite clear. The shank size and the butt size are old-style A.R.A standards. The only objection possible seems to be in the fact that there is no standard Type D coupler with a 5-in. by 5-in. shank.

If this is the objection intended, I do not believe it would hold before the A.R.A. Committee. So far as I know, there is no restriction on the type of head under the old style specifications except that the head complies with standard contour, and it would seem to be permissible to use a Type D head on a 5-in by 5-in. shank.

Such a coupler would not be a Type D standard, but it would be a perfectly good job apparently as an old style coupler, and therefore a good repair in place of a non-standard 8½ in. butt coupler.

A. M. Orr.

Chill-Worn Cast-Iron Wheels

To the Editor:

As far back as railroad history is recorded, we know that the chilled-iron car wheel has had its place in railway service and, although there have been many improvements in it, there has been much discussion as to its true value. This is probably the result of the fact that it develops chill-worn spots which is one of the most important and the most overlooked defects. Car inspectors find cracked rims, seamy rims and treads, as well as worn and broken flanges, but they seldom find a chill-worn wheel. I am inclined to believe there are many car inspectors who do not understand what a chill-worn wheel is nor how to determine it.

We have all been standing near a passing freight train where we could hear the wheels pound. The usual impression is that the car in question has a flat wheel. This is the impression of most car inspectors who hear these pounds. When they inspect the train they expect to find a slid-flat wheel but as a rule they do not find it and conclude that the noise came from some other source.

A well-informed car inspector will look for that chill-worn spot and shop the car, because he knows if that wheel is permitted to remain in service it will eventually break and may cause an accident or at least a delay.

This defect is most serious and too much stress cannot be laid on its importance. When you see the box bolts loose and shiny around the top or bottom and the tie-strap rivets loose and shiny or, if on a one-piece side frame you note the brake-hanger bolt holes shiny and worn as well as the spring plank and truck-spring seat, you will know that they are conditions caused by excessive truck vibration. In the majority of cases this is caused by a chill-worn wheel.

The chill-worn spot is deceiving and requires a trained eye to detect it. It differs from a flat spot caused by sliding wheels in that it does not have sharp corners. Some chill-worn spots reach 6 in., 8 in. and 10 in. in length and sometimes longer. Many wheels will have more than one spot chill-worn.

After a wheel rim that is chill-worn breaks it is called a broken rim wheel, new defect. In some cases this is found too late, in other words after the derailment has occurred.

A chill-worn wheel is determined by observation and there is no gage to work by. The chill-worn spot has a mottled grey-iron dull appearance. On the outer edge of the rim it shows a wider rail wear while it shows a depth wear at the throat of the flange. The spot is usually not dead flat in appearance or measurement and is caused by the wearing away of the chill which leaves the weight to be carried on the iron in the wheel which is softer than the chilled metal and which wears away faster.

A definite way to tell a chill-worn wheel is to chip the chill-worn spot with an ordinary cold chisel. The spot will show a nick if the chill is worn. With ordinary tools you will not make an impression on the chilled part of the wheel.

General Car Foreman.

A Defense of "Dirty and Inoperative"

To the Editor:

The article in the March issue, under the heading—"Dirty and Inoperative—Why?"—by An Old Air Jammer, necessitates a comment.

First he asks why use the expression—"Dirty and Inoperative." Among the several reasons why this expression is used are the following: Some roads ship triple valves to and from the point of repair. There being no 3-T test rack at the point of repair and no visible defects on the brake equipment, the record writer has but one recourse and that is the evidence of the single-car tester, which shows the car to be inoperative on account of a defective triple. He has therefore been given authority by the A. R. A. to use the word inoperative. The latest decision by the arbitration committee is Case 1666, A. R. A. Circular No. D. V.-721.

The second important reason will be found in what "Air Jammer" has to say in his article concerning air-brake supervisors and A. R. A. checkers being continually on the job checking both the testing equipment and the operators. I agree with him that the 3-T test rack is a very sensitive and accurate mechanism, therefore, only in extreme cases of emergency should dirty triple valves be placed on them for test. At the present time we have no way of straining the air blown through the triple valve into the rack at the auxiliary tube. You can readily see that if you made a practice of running several dirty valves over your rack each day without cleaning your mechanism and valves, the rack would soon become unreliable.

Reference is made to 5-lb. rings, 7-lb. being the limit allowed. We will assume that we first clean the triple before putting it on the rack and when we test it we find that the ring is too close to the limit to permit it to go. Therefore the operator applies a new ring and shows the application on his triple-valve repair sheet. Then the record writer, if he follows "Air Jammer's" suggestion in following this triple to the repair room for specific defects, must naturally show why he made the record of "defective piston ring" which would be misleading and of no value in trying to improve conditions.

The present practice, I believe, is the most economical method of handling the situation as long as we have a blanket charge covering defective interior material in triple valves.

I enjoyed "Air Jammer's" article better than anything I have read in some time and hope to see other articles on this subject in print at some near future date as his points are well taken and are very interesting.

Tom DeMond.

With the

Car Foremen and Inspectors

Cleaning Cars With Live Steam

IN an effort to furnish shippers with cars which are not only thoroughly cleaned but completely disinfected and deodorized, the New York, Chicago & St. Louis has contracted with the Kenney Railway Maintenance Company to recondition box, automobile, refrigerator and stock cars at Toledo, Ohio. The car-cleaning plant at that point which has been in operation for several months utilizes steam and hot water for performing the cleaning operations without the aid of chemical solutions. Steam at 150-lb. pressure is used for drying the cars after the cleaning is done.

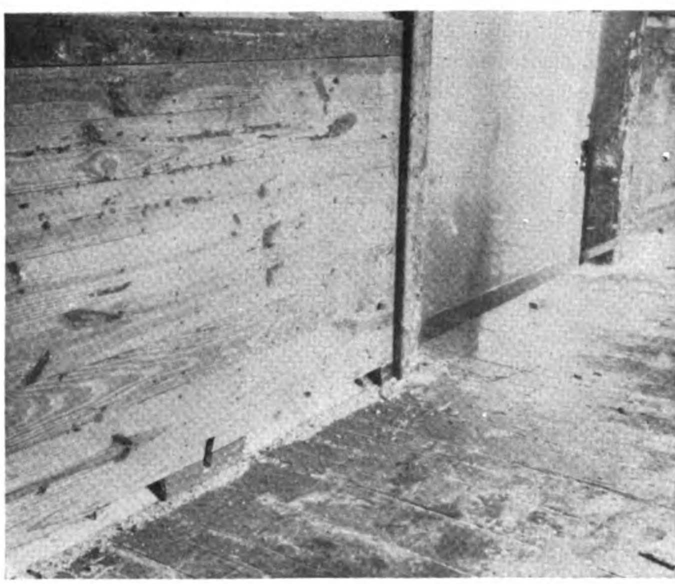
The cars as they arrive at the cleaning plant are found to represent a variety of conditions as far as interior cleanliness is concerned. The commodities or refuse therefrom which usually is primarily responsible for leaving a car in a condition unfit for immediate loading without cleaning are as follows:

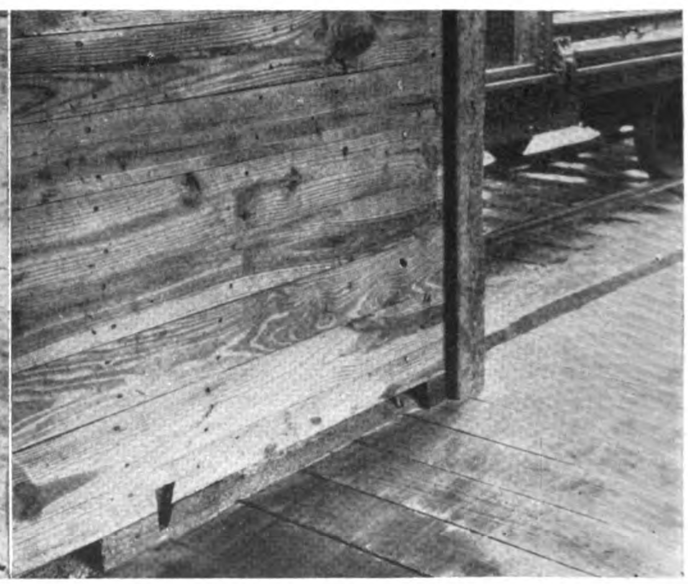
Grease and oils (spilled)	Hides
Chemicals	Sulphur
Flour	Manure (stock cars)
Lime	Vegetables
Salt	Sand
Soda-ash	Charcoal
Fertilizer	Fine ores
Cement	Terra cotta and tile
Brick dust	Refuse
Creosote	Paste and glue for lining paper
Clay	Asphalt
Paint	

In the cleaning of house cars the interior of the car is first swept out and old nails and pieces of blocking removed. The car is then dampened over the entire interior surfaces with hot water to soften up the materials which it is desired to remove. The car is then washed with hot water and steam at 150-lb. pressure, the nozzle sizes varying from 1/8 in. to 1/2 in. to control the velocity of the jets, after which the car is thoroughly flushed out with cold water and finally dried with steam at 150-lb. pressure.

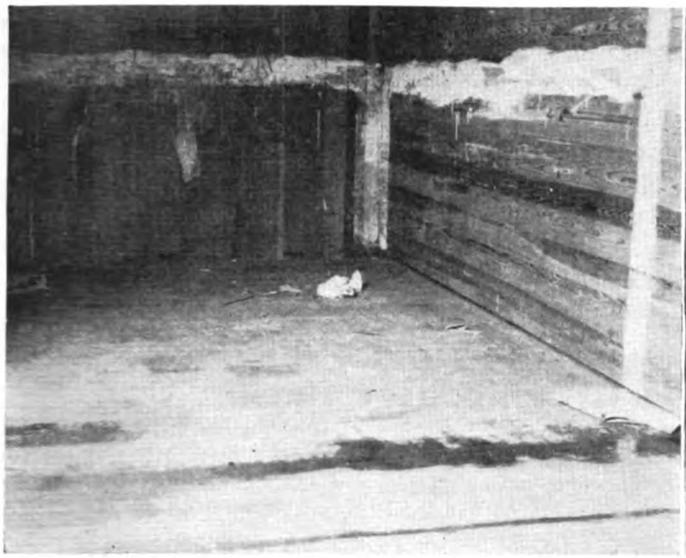
Stock cars quite often arrive at the cleaning plant during winter weather with the refuse (manure mixed with sand or straw) frozen. The same condition prevails with open-top equipment. The refuse is first thawed out with the steam jet, the car is washed with hot water and steam, rinsed with cold, clean water and finally dried out with steam.

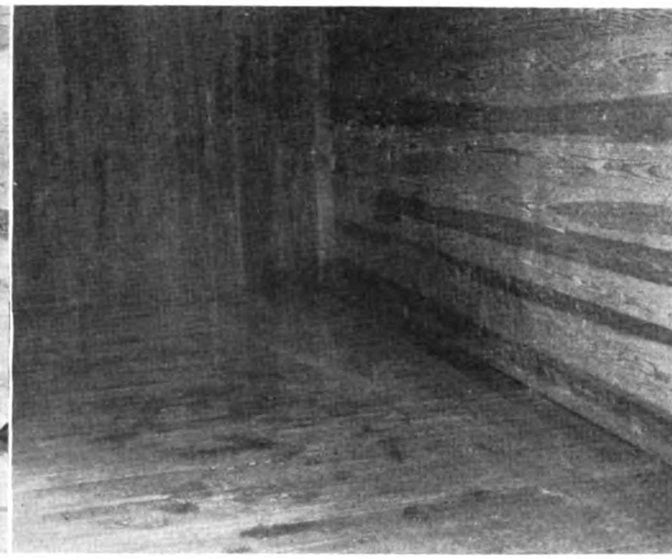
Accompanying this article are several illustrations which show actual conditions in two types of cars before and after cleaning. In one case an automobile car arrived at the cleaning plant with the walls in an unsightly condition, as a result of pasting lining paper on them, and the floor was marked by numerous grease spots and spilled oil. The cleaning process removed all of the grease, oil and paste from the floor and walls and removed the paint over spots on the floor from which grease had previously been removed by the use of a torch. In the illustration of the automobile car after cleaning, these burned spots showed up plainly. Before the car is sent out again these burned spots are painted over. The other car shown in the illustrations is a box car in which a shipment of soda-ash had been loaded. When the car arrived at the cleaning plant, the refuse from the previous shipment of soda-ash was not only on the floor and wall surfaces of the car but was behind the inside lining as well. This is shown clearly in one of the photographs taken near a door of the car. In some respects, this car did not present as difficult a cleaning job as the automobile car except that more thorough flushing and washing were necessary. The other photograph in that group shows the condition of the car after being washed and flushed but before the final rinsing and steam drying. Cars of the type shown in the illustrations re-





Left: The condition of a box car after a shipment of soda-ash. A large quantity remains behind the inside lining—Right: After steam-cleaning and flushing. Note the cleanliness as evidenced by the clearly visible grain in the wood





Left: An automobile car with lining paper paste on the walls and grease and oil on the floor. Grease spots from previous shipments have been burned out and painted over.—Right: The same car after steam cleaning. Paste, grease, oil and paint are removed from the floor showing plainly the burned-over grease spots

quire about 40 min. on the average for complete cleaning.

There has been some criticism of the steam method of cleaning because under certain conditions the application of steam or hot water raises the grain on the wood and creates a rough floor. With the system described in this article the time required for the cleaning is so short that there has been no indication of any roughness in car floors as a result of the use of steam or hot water.

Wheel Inspection*

By D. M. Raymond †

ONE of the most important responsibilities of the mechanical departments of the railroads is that of wheel and axle inspection and maintenance, for which large sums of money are expended annually and which, when not properly done, often causes delays in both the mechanical and transportation departments. The proper inspection of wheels for wheel defects is one that cannot be given too much thought by supervisors. Some inspectors shop cars for wheel defects which, in a great many cases, are not condemnable. It is supervisor's responsibility to see that wheels are not removed until defects reach the condemning limit.

Slid-Flat and Shelled-Out Wheels

There should be no question on the slid-flat defect. Wheels should not be removed until they have a spot of 2½ in. or over in length, or two or more adjoining spots 2 in. or over in length on freight cars, and 1 in. in length on passenger cars. All of these spots should be dead flat. This defect is not dangerous in so far as the wheel is concerned, but it is liable to damage the rail and create extra rolling resistance. Neither should there be any question as to when a shelled-out wheel is condemnable as the rules state specifically that it shall not be removed from service until the spot has reached 2½ in. or over in length on freight cars and 1 in. in length on passenger cars. The shelled-out spot derives its name from the fact that it resembles an inverted oyster shell with a high center and it is generally believed to be a manufacturer's defect caused either by the inclusion of foreign material of some kind, or by seams underneath the surface metal, parallel to the tread of the wheel. It is not necessarily dangerous from the viewpoint of wheel safety, but has practically the same effect as a slid-flat spot. A seam in a cast-iron wheel is one of the most serious defects and, when located close to the flange, it is liable to cause the flange to break off. Any seam running circumferentially within 3¾ in. of the flange, measured at a point of ⅝ in. above the tread, is condemnable.

Worn-through Chill

This is the only judgment defect left in the Wheel and Axle Manual and, in the opinion of the writer, it causes more trouble and expense than any other wheel defect. It is the cause of a great many derailments because the worn-through chill wheel is out of round and, at high rates of speed, it will shake the truck to pieces. In a great many cases when brake rigging is changed and new arch-bars and new truck bolts are applied, wheels with worn-through chills are left in the car. There are a number of railroads which do this and, by paying little or no attention to wheels with worn-through chill spots, are thus repairing trucks without removing the cause of the damage. This defect is well defined in the Wheel and Axle Manual and explains how it should be condemned. However, it does not explain how the defect should be detected. In most cases, an inspector familiar with this defect can detect it by the condition of the truck, which is generally shaken to such an extent that bolts, pins, brake shoes and oil-box lids are polished in various places by vibration. When a condition of this kind is found it warrants a close inspection of wheels and, if a wheel is worn through the chill and an out-of-round condition has developed, it should be condemned and removed. The rules specify that the wheels should not be removed until a flattened-out spot has developed. However, a worn-through chill never gets entirely flat, but rather gets out-of-round.

Worn and Thin Flanges

The only caution necessary in the case of worn

* Paper presented before the February meeting of the Omaha Car Foreman's Association.

† Mr. Raymond is general car foreman of the Union Pacific at Council Bluffs, Iowa.

flanges is to properly apply the gage. Wheels are often condemned for having a vertical flange that are not properly condemnable. In order to condemn a flange for being vertical, the flange must come in contact with the limit point of the gage and not merely have a flat surface to the limit height. In order to be sure it does come in contact, a good practice is to take a piece of writing paper and try it between the contact point of the gage and the flange because it is often difficult to see whether the points come in contact or not. If the point does not come in contact with the flange, it should not be condemned. This wheel is not dangerous unless it is below the condemning limit and then it may lead to the breakage of the flange.

The method of gaging a thin flange on cast-iron wheels is simple and there should be no misunderstanding in the proper condemning of this defect. If the gage is not properly applied, that is, if it is tipped or tilted, the wheel will not be properly condemned. For cast-iron wheels of less than 80,000-lb. capacity, or wrought-steel, steel-tired, or cast-steel wheels, the wheel is condemnable if the flange is less than $\frac{15}{16}$ in. thick; wheels of 80,000 capacity or over are condemnable if the flange is less than 1 in. thick.

Brake-Burned and Comby Spots

There should be no misunderstanding of the proper condemning of wheels for brake burn, as transverse cracks in the tread are condemnable if they extend into the throat of the flange, into the flange, or are $2\frac{3}{4}$ in. in length. Considerable difficulty is often encountered by inspectors in properly condemning wheels with comby spots which are the result of brake burn. A wheel with comby spots is gaged the same as a slid-flat wheel and is not dangerous unless the material has fallen out of the tread for a continuous length of $2\frac{1}{2}$ in. or over, or from two adjoining spots 2 in. in length or over on freight cars and 1 in. or over on passenger cars.

The wheel with a tread worn hollow is easily distinguished and should not be condemned until it takes the tread-worn-hollow gage. Little trouble is experienced in educating inspectors how to gage tread-worn-hollow wheels properly. Usually, however, very few wheels can be found which will take tread-worn-hollow gage before they are condemnable for some other defect.

A burst hub is usually the result of excessive pressure when mounting, caused by an improper wheel fit, gouging, or by excessively hard metal in the hub. Cracked or broken flanges, plates or brackets are very dangerous, because wheels with these defects are liable to fail at any time. Cracks or breaks usually appear on the inside face of the wheel. Cracked plates or brackets are generally caused by excessive heat, dirt in the plates, thin plates, or hard plates, the latter resulting from improper annealing. The single-plate wheel has overcome this defect to a great extent, but inspectors should be made to realize that whenever they see any indications of sticking brakes, or red or burned brake shoes, they should give the wheels careful inspection for cracks in the flange, plate or bracket.

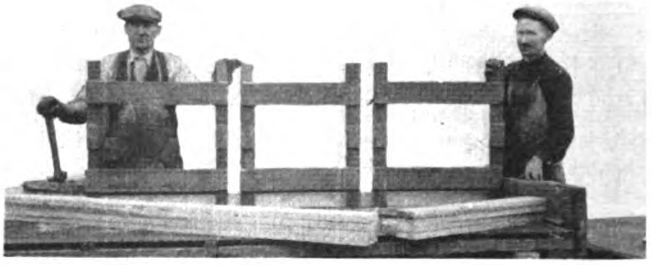
There should be no question as to proper condemning of chipped flanges as the rules state plainly that they should not be condemned unless they are more than $\frac{1}{2}$ in. in width and $1\frac{1}{2}$ in. in length.

Broken and Chipped Rim

Wheels are often condemned for broken or chipped rims where the metal is just flaked off in small areas. The wheel should not be condemned for this defect unless the rim is chipped off to the extent as shown in the rules, that is, where the fracture or break in the rim slopes outward. It is condemnable only if the width of the tread at the point of fracture is less than $3\frac{3}{4}$ in., (gaged at a point $\frac{5}{8}$ in. above the tread) and the circumferential length of the fracture is $2\frac{1}{2}$ in. or over. Where the fractures are reduced to $3\frac{1}{2}$ in. or less, gaged at a point $\frac{5}{8}$ in. above the tread, it is condemnable at any length, or where it is reduced to $3\frac{3}{4}$ in. and extends inwardly.

Lading Racks for Refrigerator Cars

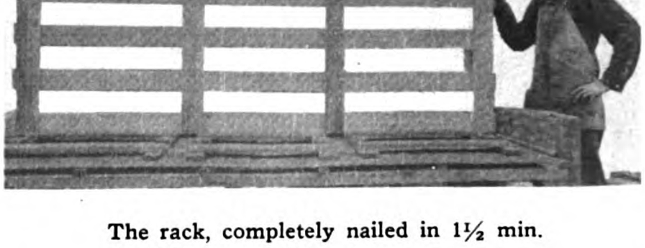
THE racks which are used in refrigerator cars for separating layers of various types of crated lading are made by hand. Large numbers of them are required by roads handling large shipments of this type



The three-piece jig used for separating the strips preparatory to nailing them

of lading, because they are often removed from the car when the lading is unloaded.

These racks are usually built of four 1-in. by $2\frac{1}{2}$-in. boards tied together by four strips of the same size in the manner shown in one of the illustrations. When making these racks an eastern road uses a jig of three pieces, also shown in one of the illustrations, which is laid on a table with a sheet-iron top. The short cross-tie strips are placed between and at the ends of the three pieces of the jig, resting on the table top. The long strips are then laid perpendicular to the short strips, fitting in the pockets of the jig which are formed by blocks

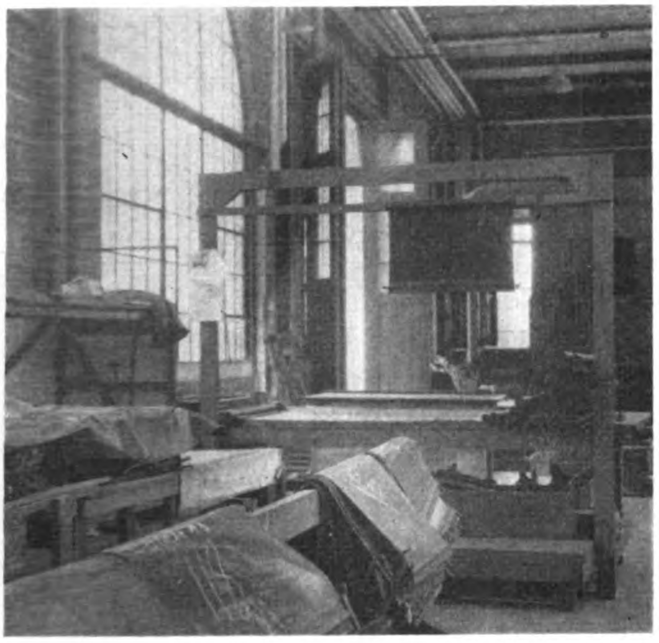


The rack, completely nailed in $1\frac{1}{2}$ min.

and strips nailed on the jig cross pieces. When the short and long strips are in place, the nails are driven and are turned when they strike the sheet-iron top of the table. The rack can be made by the use of this jig in $1\frac{1}{2}$ min., this time including procuring the short and long strips and removing the rack from the jig when completed.

Repairing Coach Window Shades

THE coach repair department at the Miller Shops of the Florida East Coast, St. Augustine, Fla., has included in its facilities a bench, which is complete in practically every detail, for the repairing of window shades for passenger-train cars. The bench is of wood construction, built with the front legs extending up and connected with a cross piece at the top to form a frame,



Bench and rack for repairing window curtains in the Miller coach shops of the Florida East Coast

above the top of the bench, as shown in the illustration. Window-shade fixtures are mounted on a second bar, which is secured to the frame about 6 in. below the top. All shades are tested to see that the roller operates properly. If defective, repairs are made on the bench directly beneath. Repairs to shades, rollers, stops and all appurtenances are made on this bench.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Car Damaged In Unfair Usage

On February 4, 1929, M-K-T wooden box car 88181 was bad ordered by a Georgia inspector at Augusta, Ga., for loose truss rods. After being placed on a light repair track, shop inspection disclosed further defects which necessitated the removal of the car to the heavy repair track, but no written record of the additional defects were made.

While the car was being switched to the heavy repair track it was damaged as a result of misinterpreted signals. Before making repairs the Georgia had the car jointly inspected by representative of the Charleston & Western Carolina, the Georgia & Florida and the Georgia to determine which defects were the result of the damage sustained in the switching movement and which defects existed prior to that movement. A bill for the repairs of the defects existing before the switching movement was made was submitted to the M-K-T but was declined. The Georgia then amended the bill to include the cost of all repairs made.

The Georgia based its contention, that the amended bill as submitted was correct, on the fact that although the car was damaged under the conditions set forth in Section (d), Item 2 of Rule 32, the car was not damaged to the extent set forth in Rule 44.

The M-K-T contended that, since the handling line had no record of the defects existing on the car until the inspection was made after the car had been damaged under the conditions set forth in Item 2, Section (d) of Rule 32, the handling line was responsible for the damage. It also produced records which showed that the car had been repaired 12 days previously by the Atlantic Coast Line and which indicated that no defects other than those repaired by the A. C. L. existed on the car at the time the repairs were made by that road.

The decision as rendered by the Arbitration Committee follows: "In view of the unusual circumstances in this case, settlement should be made in accordance with Rules 32 and 41 on the basis of the joint inspection by the two disinterested inspectors."—*Case No. 1654—Georgia vs. Missouri-Kansas-Texas.*

Relightweighing Cars in Motion

During 1927 and 1928 the Western Maryland relightweighed a considerable number of Baltimore & Ohio cars for stenciling and billing in accordance with A.R.A. Interchange Rule 30. The cars were weighed while in motion with a rider, the speed being restricted to six miles an hour which allowed the car to be on the suspended-platform track scales a minimum of four seconds. The billing of 761 cars relightweighed during December, 1927 included 392 cars reweighed on account of variation in weight; 213 cars reweighted on account of being out of date and 156 cars reweighed on account of illegible markings. The B. & O. pointed out that the Western Maryland had no facilities for cleaning cars at Hagerstown, Md., the point where the cars were relightweighed. The B. & O. took 92 cars that were previously relightweighed by the Western Maryland and weighed them to determine any error in the Western Maryland figures. The cars were uncoupled and test weighed at rest. They showed variations between the Western Maryland old weight and the B. & O. new weight of from 20 lb. to 3,300 lb. Only 27 per cent of the test-weighed cars were within the 50 lb. limit prescribed by Rule 30, Section A, Paragraph 3. It contended that the Western Maryland violated Rule 30, Section F, Paragraph 9 of the Interchange Rules by weighing cars in motion and Paragraph 3 by weighing cars with the rider and not properly cleaning them before weighing. The B. & O. examined 2,722 cars at various points for illegible markings and stenciling and found that 2.33 per cent of these cars were marked or stenciled illegibly. The lightweight record of 451 of these cars, which were subsequently relightweighed by the Western Maryland was compared with the Western Maryland record of these cars, taken from their billing repair cards. This comparison showed discrepancies between the two records as follows: 53 per cent in old weight, 47 per cent in old

initial and 67 per cent in old date. The B. & O. contended that this indicated correct information was not furnished on the Western Maryland billing repair cards and claimed that it should cancel its charges.

The Arbitration Committee rendered the following decision: "In order to justify charge for properly relightweighing and remarking an empty car on basis of Rule 31, the car should be relightweighed at rest, uncoupled and free at both ends, as required in Paragraph (9), Section (f), Rule 30; it should also be clean and dry, within requirements of Paragraph (3) of the same section, and should conform to the other prescribed requirements of the rule.

"Settlement should be made accordingly; with the understanding however, that this decision is confined to the cars that were incorrectly remarked."—*Case No. 1656—Western Maryland vs. Baltimore & Ohio.*

Wholesale Use of Free Oil Condemned

By a Chief Car Inspector

A. R. A. Rule 66 was introduced primarily to minimize hot boxes and thereby improve freight- and passenger-train operation. That the objectives sought are being attained is manifest by the generally improved conditions of journal boxes and their contained parts. Today, journal lubrication is receiving closer attention than ever before, both as to the qualities of the lubricants used and the methods of treatment employed.

In addition to the periodic repacking and practices set forth in this rule, some roads have adopted a policy of using free oil, injecting it either by means of the oil can or the pneumatic system, in the boxes of cars before they pass over the hump or in despatchment yards prior to departure from terminals, on the theory that it further enhances lubrication of the journals.

The wisdom of such a policy has been the subject of considerable discussion. Some lubrication engineers contend it is helpful, while others claim it is wasteful.

The writer does not subscribe to the policy of free oiling in any such wholesale manner for the reason that it is both detrimental and wasteful and therefore should be discouraged as general practice. Where the practice prevails the application of free oil becomes mechanical; in other words, instructions are issued that all cars shall receive such treatment with the result that many a box gets a shot of oil whether it needs it or not and the writer ventures to say that the oil is more often deposited in the front than in the rear of the box. Of course it is well known that it is essentially important to carry the lubricant to the fillet end of the journal.

One evil from excessive oiling is that the packing becomes over-saturated and soggy thus impairing its resiliency. Furthermore, the presence of surplus oil frequently causes the waste to move out of position and when the packing iron is used the oil is forced out at the back of the box.

At best, free oiling is a hit-or-miss system. Oilers are seldom interested in knowing the quantity of oil necessary and usually it is injected without first adjusting the packing along side and back of the journal, hence the purpose of adding free oil is defeated.

Emergencies will occasionally arise when free oil is advantageous, for example in the cases of cars that have been stored or idle for a considerable length of time and as a consequence the oil has settled to the bottom of the box. In such circumstances the addition of a little free oil will temporarily lubricate the journal until normal running temperature is attained and capillarity reinduced, thus causing the waste again to feed oil to the journal.

In the last analysis the use of large quantities of free oil, with questionable results, is expensive. A practice that is less expensive but insures results is to adjust the packing to proper position against the journal and insert a piece of fresh packing against the rising side of the journal at terminals when the condition of the box indicates that such attention is necessary.

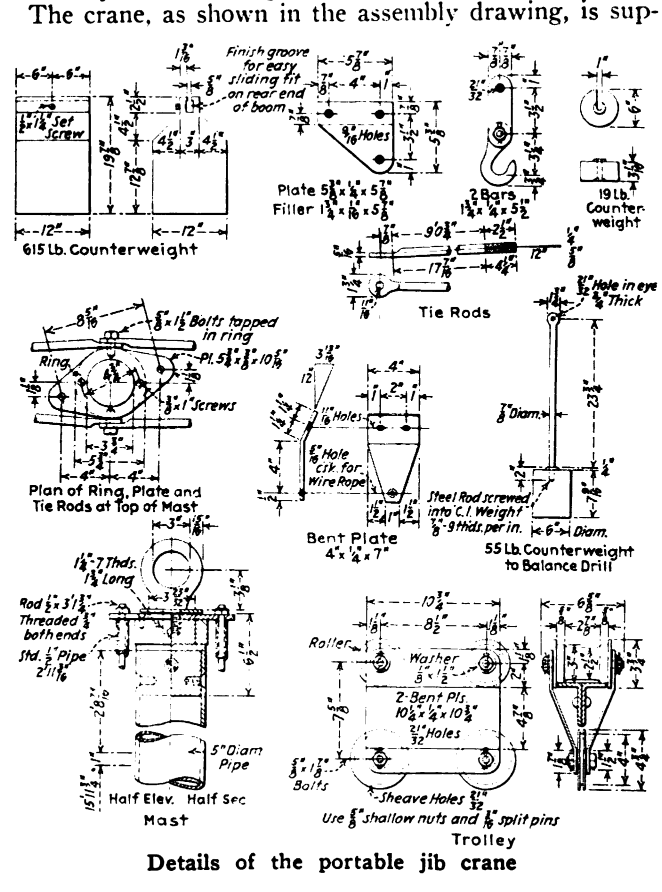
If railroads, however, will use satisfactory lubricants, both new and renovated, in the boxes of home as well as foreign cars and follow a program of periodic rejacking and repacking as outlined in Rule 66 any need for the use of free oil could be appreciably reduced and a considerable saving effected in car set-outs as well as in oil costs.

It would be interesting to get the views of those who advocate free oiling as they may have made some discoveries that would open up a new avenue of thought on this much mooted question.

Portable Jib Crane For Power Tools

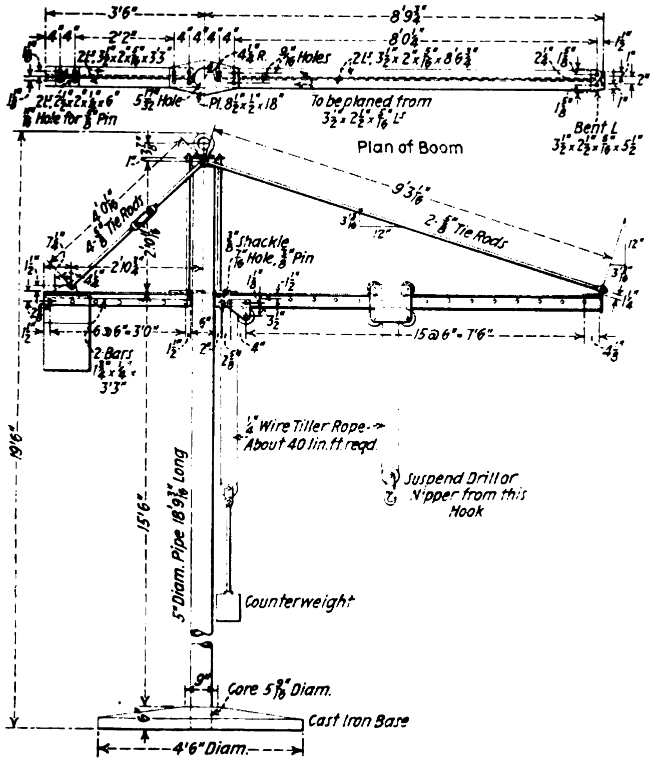
THE portable jib crane, the assembly and detail parts of which are shown in the two drawings, is used in the shops of a car manufacturer and also on several railroads in the east. This crane was designed primarily to lessen the labor of handling and operating air and electric tools along the side of a car or on the truck-repair track. Nippers, rivet busters, power drills and heavy hand tools of similar nature are suspended from the hook when in use. This method not only relieves fatigue, but frequently enables one man to perform work where ordinarily two are required.

The crane, as shown in the assembly drawing, is sup-



Details of the portable jib crane

ported on a cast-iron base weighing 2,625 lb. In some shops where this crane is used, it is carried on a four-wheel hand truck. The maximum operating radius of the hook is 8 ft. The height from the bottom of the base to the bottom of the boom is 15 ft. 8½ in. The trolley and boom are counterbalanced as shown to permit easy



Assembly drawing of the portable jib crane

operation of the crane and tool. All of the parts are of wrought iron, with the exception of the base and counterweights, which are of cast iron.

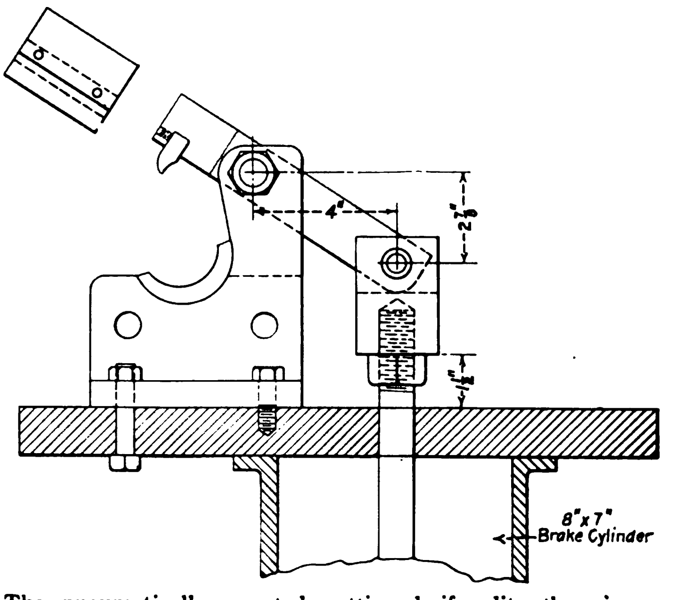
Device for Removing Fittings from Hose

When it becomes necessary to remove fittings from scrap steam and air hose, the pneumatically-operated cutting knife shown in the drawing can be used effectively. It is comprised of an 8-in. by 7-in. brake cylinder, the piston rod of which actuates the cutting knife. The cylinder is mounted beneath the work bench to which is bolted the stand for holding the hose while it is being cut along the fitting stem. The stand is designed to hold steam hose but by inserting the bushing shown in the detailed drawing it can be used for cutting the smaller air hose.

The stand is built up by riveting a right-hand and left-hand section to a central block which is machined with a concave recess for inserting the hose and which is 1½ in. thick, 3⅜ in. high and 5⅞ in. long. The right-hand and left-hand sections are also machined with the concave recess for holding the hose during the cutting operations. When riveted to the central block the assembly has a solid base with a total width of 3 in. The central block does not extend into the upright part of the end sections, leaving the 1½-in. space between the uprights to be used as a fulcruming point for the cutting lever.

The cutting lever is attached to the piston rod of the brake cylinder at one end and fitted with the cutting blade at the other. Two cutting blades are used, one for steam hose and the other for air hose. Both blades have a thickness of ½ in. and a length of 3 in., but the width of the former is 1⅛ in. while the width of the latter is 1 5/16 in.

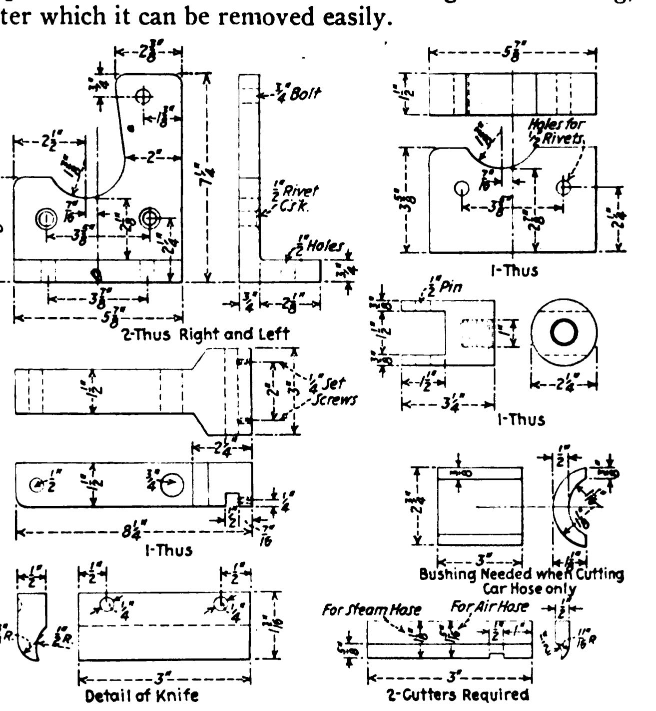
When cutting steam hose, the smaller blade is inserted



The pneumatically-operated cutting knife slits the air or steam hose parallel to the fitting after which the fitting can be removed readily

in the cutting lever and the hose is placed in the concave recess machined in the right-hand and left-hand sections and in the block riveted between them. As the air is applied, the cutting knife comes in contact with the hose, parallel with the center line of the hose fitting. The blade severs the hose along the fitting stem, after which the fitting can be removed readily by hand without any effort.

When cutting air hose, a bushing is placed in the recess of the stand. This bushing is machined with a 1 1/16 in. face radius suitable for holding the air hose firmly while the pressure against the hose and fitting is being applied. The cutter slits the hose through to the fitting, after which it can be removed easily.



Details of the air- and steam-hose cutting device

In the
Back Shop and Enginehouse

Testing Gas Engines For Rail-Motor Cars

By E. O. Whitfield *

WHEN a gas-electric rail car arrives in the shops for general overhaul under the unit-replacement system, the engine, generator and bed plate are removed from the car and a complete tested unit is installed. This procedure also applies to the trucks, compressors, and other equipment. Therefore, the only time that the motor car is out of service is that required to remove the units needing to be overhauled, and to install reconditioned and tested units.

The method and equipment used are shown in the three illustrations. Referring to Fig. 1, all engines scheduled for overhaul are dismantled, cleaned in the lye vat shown at the right of the illustration, repaired and tested on a hydraulic dynamometer. The dynamometer is located in the shed shown in the center background. A one-cylinder air motor is connected to the rear end of the shaft by means of a detachable coupling. This motor is used to operate the engine up to the point in the test where the engine is run with its own power. A belt over the flywheel, shown in Fig. 2, drives the sub-frame assembly which consists of the transfer case, transmission and air compressor.

Fig. 2 shows the interior of the dynamometer shed, with the hydraulic dynamometer *B*, in the foreground. The engine *A*, undergoing test, is shown in the background.

Fig. 3 is a view from the end opposite that shown in Fig. 2. The gage *B* is a tachometer which gives the speed rate of the engine in revolutions per minute. The dynamometer *C* is shown in the background. The two pipes *D* are for the exhaust.

* Mr. Whitfield is supervisor of rail-car maintenance and inspection on the New York, New Haven & Hartford.

Each engine undergoing test is run for one hour at full load and speed. Any defects noted during the test are corrected and the engine is then marked OK for service. A log is kept during the block test on which all features of operation are recorded at regular stated intervals. This procedure insures an engine which will perform satisfactorily in service, due to the fact that all irregu-

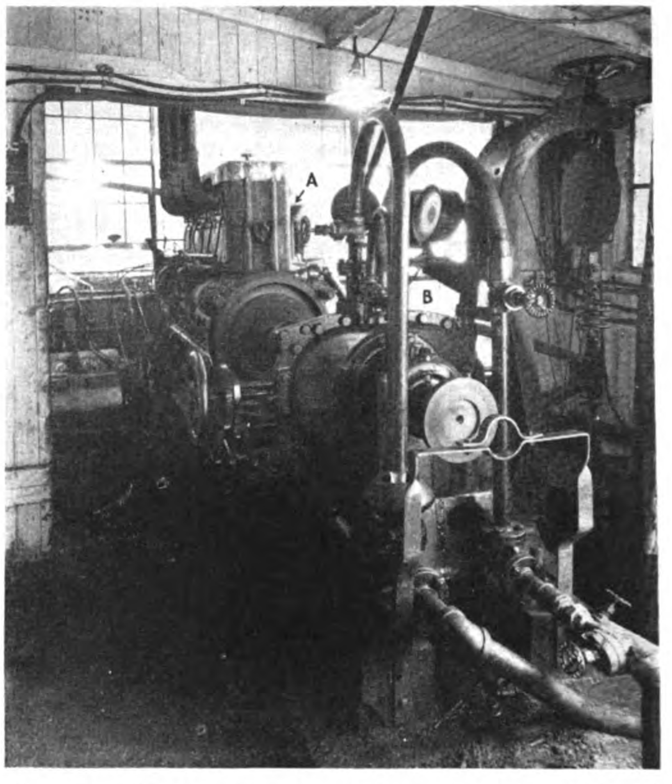


Fig. 2—Engine being tested on the dynamometer shown in the foreground

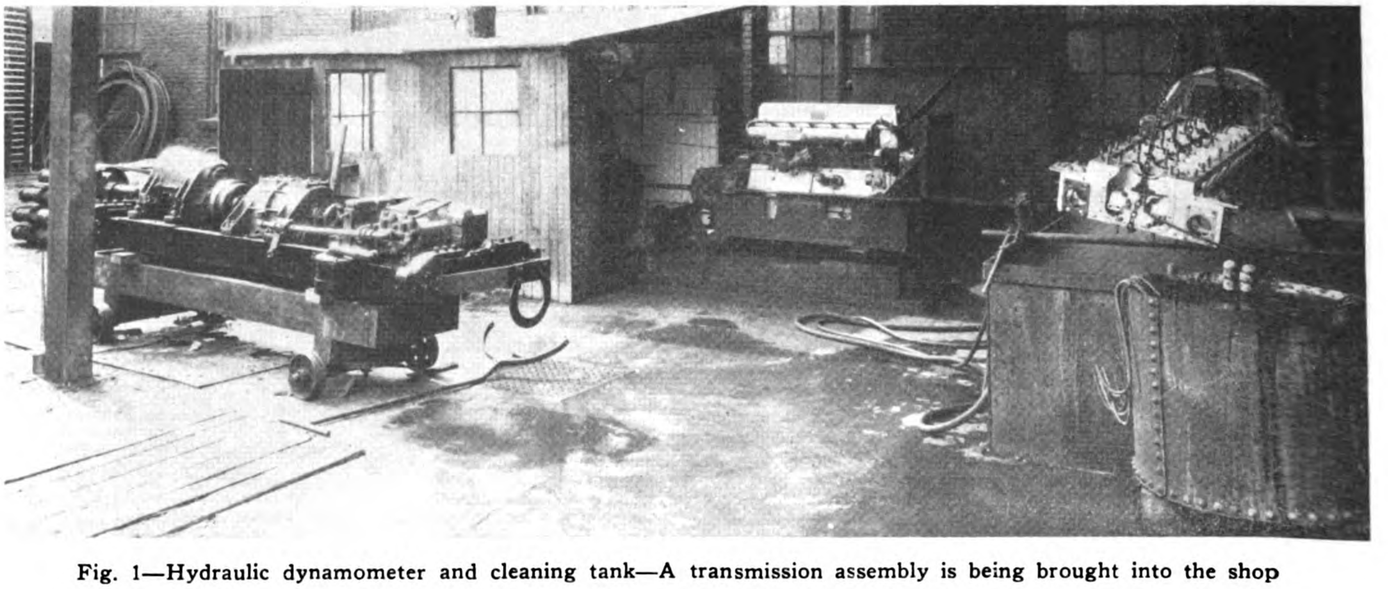


Fig. 1—Hydraulic dynamometer and cleaning tank—A transmission assembly is being brought into the shop

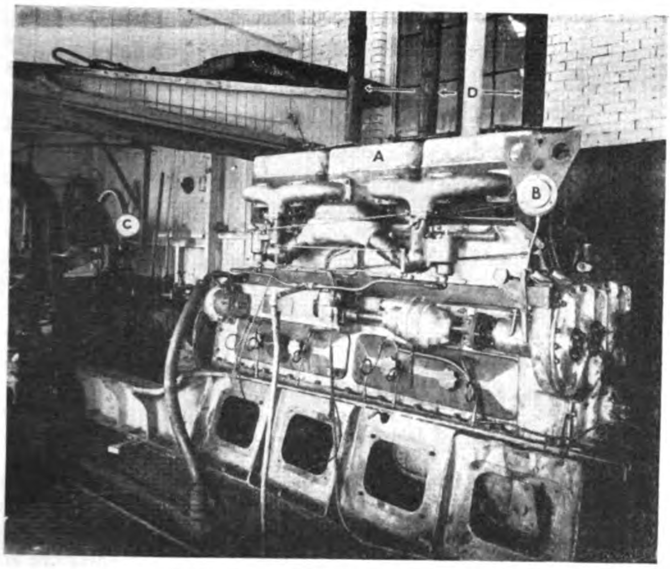


Fig. 3—Each engine is tested one hour on the dynamometer

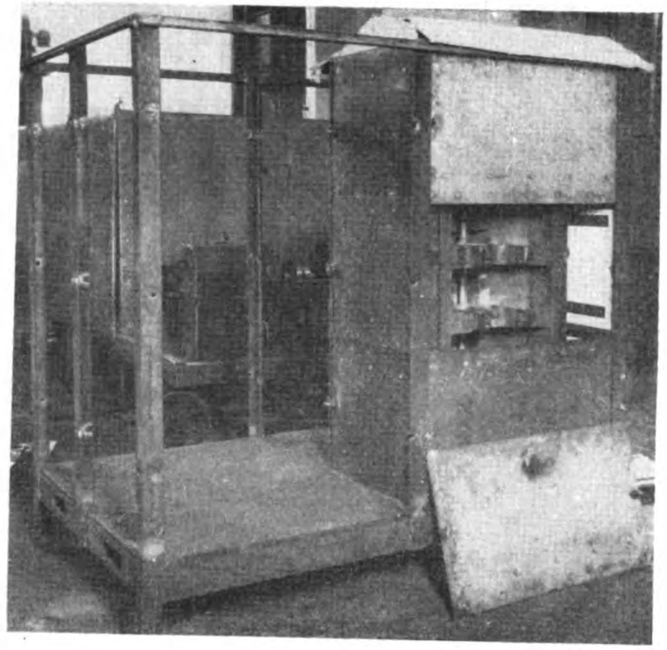
larities in engine performance are noted, rectified and checked under test.

Each engine is tested on its own bed plate and the various connections to the dynamometer are made to conform. The water tank and engine shown in Fig. 1, however, are on a bed plate which was made for a series of tests run in connection with a special investigation. The expenditure necessary in testing the different units of the power plant of rail-motor cars is economical, especially from the standpoint of increasing rail-car availability.

A Sectional Preheater

In many locomotive repair operations which involve more or less extensive autogenous welding, preheating is required in order to take care of expansion and contraction. Too often the preheating device, or furnace, built up of firebrick, sheet iron and asbestos, is little more than a makeshift, the construction of which represents considerable lost time and some material for each weld. An unusually clever and convenient sectional preheating furnace has just recently been devised at the West Burlington (Iowa) shops of the Chicago, Burlington & Quincy, as shown in the illustration. The principal advantage of this preheater is its ready adaptability to hold locomotive forgings of various sizes and shapes, standing in either a vertical or horizontal position, and leaving little clearance space. It also provides for the removal of small panels, located immediately over the parts to be welded. The use of this preheating furnace tends to save time in constructing a temporary preheating enclosure of the required size, promotes fuel economy, saves time in the actual preheating operation, and permits the welding operator to work with maximum convenience at the immediate point of the weld without exposing other parts of the forging or casting to the atmospheric temperature.

The preheating furnace is 72 in. long by 48 in. wide by 60 in. high inside. It comprises essentially an angle and T-iron framework mounted on a hollow steel base which is divided into four quarters by interior partitions and is provided with a small rectangular opening to each, through which air from the shop air line can be supplied under pressure for starting fires quickly. Two of these rectangular openings are shown in the illustration. The top plate of the base is $\frac{7}{8}$ in. thick and is drilled with $\frac{3}{8}$-in holes, spaced about 4 in. on centers to supply air for combustion to the furnace space above. The lower plate of the base consists of $\frac{3}{16}$-in. steel. Narrow end and side plates are welded in place to complete the hollow base construction. Individual air lines to the four sections of the base are piped so that air can be admitted to any one, two, or all of them, under equal pressure and controlled by a single master valve.



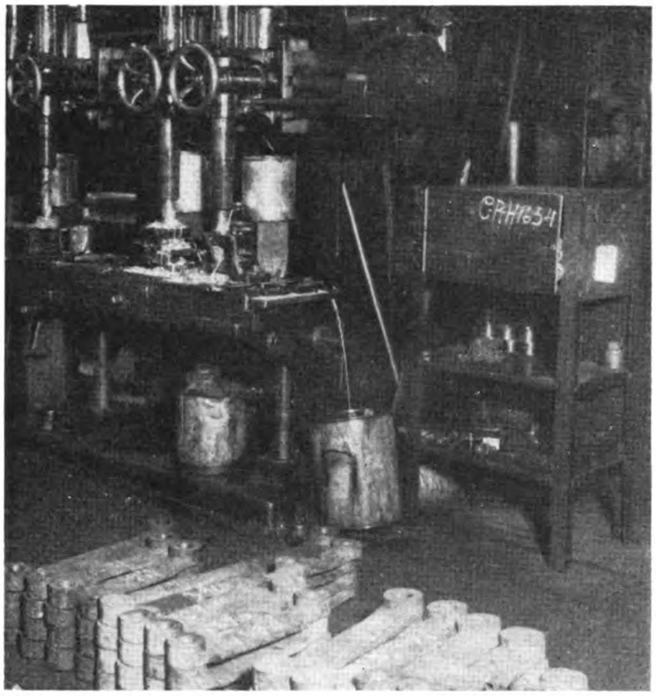
Sectional preheating furnace developed at the West Burlington (Iowa) shops of the C. B. & Q.

The corner posts of the furnace consist of $2\frac{1}{2}$-in. angles, and the center posts of $2\frac{1}{2}$-in. T-iron, connected at the top by smaller angles welded in place. The furnace walls are made of No. 18 gage iron panels, lined with asbestos millboard and provided in sufficient number to cover the sides, ends and top of the preheater, making it into one large furnace if necessary, or smaller sections, as required. In case a low casting requires preheating, the furnace need be built only high enough to cover it.

The particular job shown in the illustration is preheating a casting which requires one-fourth of the preheating furnace area for the full height. A layer of firebrick is placed on the base of the furnace as a protection against excessive heat and warpage of the heavy steel base plate. Care is taken to see that the air holes are not plugged and a charcoal fire is started, the casting being supported high enough above the firebrick to leave room for a bed of incandescent fuel. One or more of the side-wall panels is removed, as required, for greatest convenience in the welding operation.

Jig for Drilling Spring Hangers

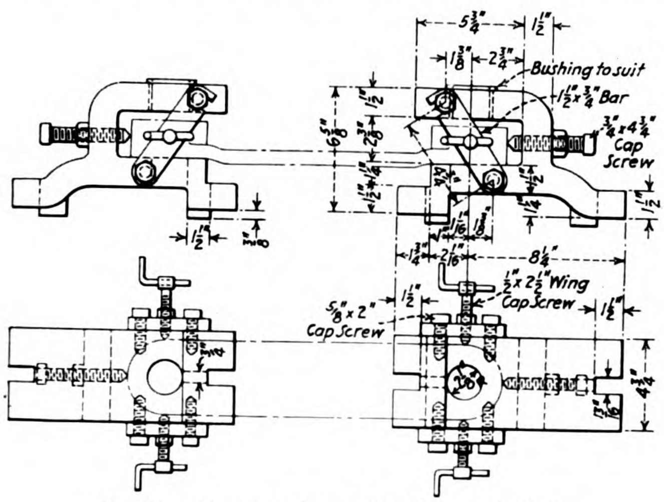
One of the important features of any locomotive shop is the care and attention given to spring-rigging repairs and the maintenance of standards which will assure satisfactory riding qualities and the delivery of the proper pressures to the front and back trucks, as well as to each pair of driving wheels. A group of forged spring hangers at the Chicago shops of the Chicago & North Western is shown in one of the illustrations. The



Four-spindle drill equipped with the jig for drilling spring-hanger holes

forging operation provides for the removal of the bulk of the material from the spring-pin holes to save time in subsequent drilling. These holes must be drilled out to the proper size, however, and the center distances accurately located.

A four-spindle drill is used for this purpose, a special



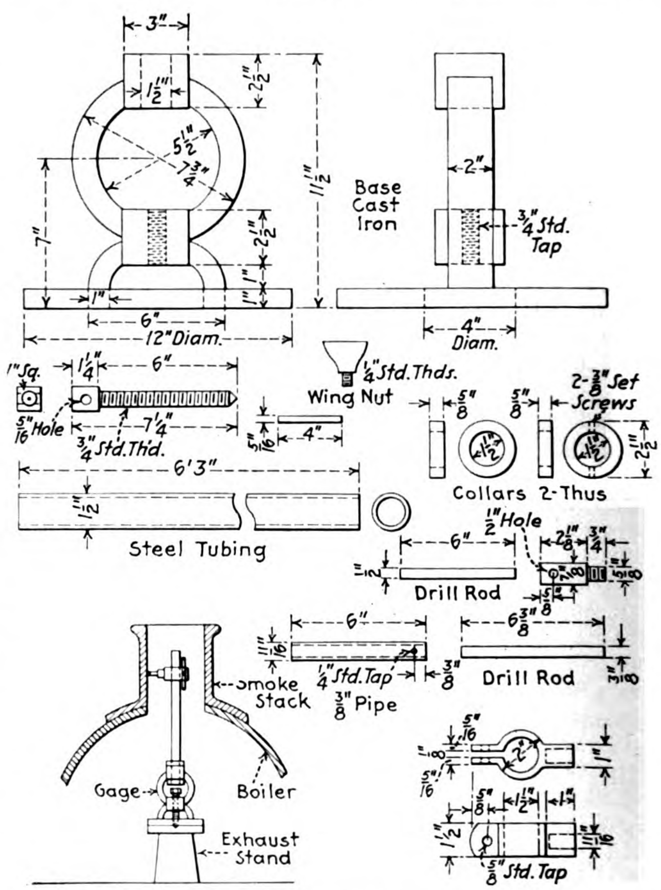
Details of locomotive spring-hanger drill jig

jig being employed, the details of which are shown in the drawing. This jig consists of two forgings, provided with recesses to receive the spring-hanger ends and capable of adjustment along the drill table to give the proper center distances. Two projections, or tongues, in the base of each forging fit in the T-slot, and each forging is securely fastened to the drill table by means of two T-bolts. Three set screws in each forging serve to position the spring hanger and a hardened-steel bushing guides the drill, the diagonally positioned holding or safety bar on the front of each forging having the upper bolt hole cut away on one side so that the bar can be quickly revolved out of the way for the insertion or removal of the spring hanger. The set screw in this bar is provided with a handle so that it can be readily set up without the use of a wrench. Once the jig is properly located on the drill table and the set screws adjusted for a certain size of spring hanger, the only additional motion necessary for the drilling of the spring-hanger holes is the tightening or loosening of the cap screw in the safety bar and swinging it into or out of position for holding the hanger. The hardened-steel bushings are a hand-fit in the forgings and are provided in different sizes to accommodate the different sizes of spring pin holes. By the use of this jig, spring-hanger holes may be drilled out with every assurance that they will be of the proper size and accurately located.

Gage for Setting Up Smoke Stacks

ONE of the methods most frequently used for alining and setting up a smoke stack employs a gage similar to the one shown in the drawing. This gage, designed and used on an Eastern road, consists of a suitable base for mounting the gage on the exhaust stand, a 6-ft. 3-in. section of 1½-in. o.d. steel tubing, collars for securing the tubing to the base, and a clamp which forms the holder for the scribber.

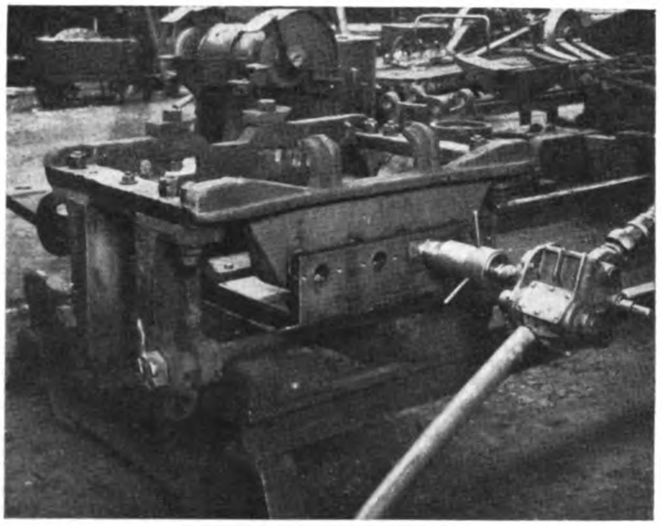
The base of the gage is 12 in. in diameter, 11½ in. high and is of welded construction. The base plate is 1 in. thick, bored to a diameter of 4 in. at the center. Two 1½-in. by 2½-in. by 3-in. steel blocks are welded in the positions shown on the drawing, being separated by the 1⅛-in. by 2-in. curved pieces of bar steel. The lower block is drilled and tapped for the insertion of a 1¼-in. by 6-in. pointed centering screw, which is used to center the gage above the exhaust stand. The center is usually located by wedging a piece of wood across



A gage which can be used effectively for setting up smoke stacks

the opening of the stand and locating the center on it, using morphodite calipers. The point of the centering screw is then alined with the center of the stand thus found.

The upper block is drilled to a diameter of 1½ in. for the insertion of the section of steel tubing, which is held securely in a vertical position by clamping a collar on the tubing at each face of the block. A split clamp, tightened by a ¼-in wing nut, is used as a holder for the scriber which bears against the inside of the stack, indicating the direction in which the stack has to move in order to center it. The scriber must necessarily be used at several points in order to insure the stack being perpendicular as well as centered, small wedges being used under the stack on the outside of the smoke box to level it as necessary. It is generally considered advisable to set a level against the stack extension, which has a plane machined surface for attaching the petticoat, to ascertain if the stack is perpendicular, thus checking the setting as made by the gage described.



Another view of the boring jig, set up ready for operation

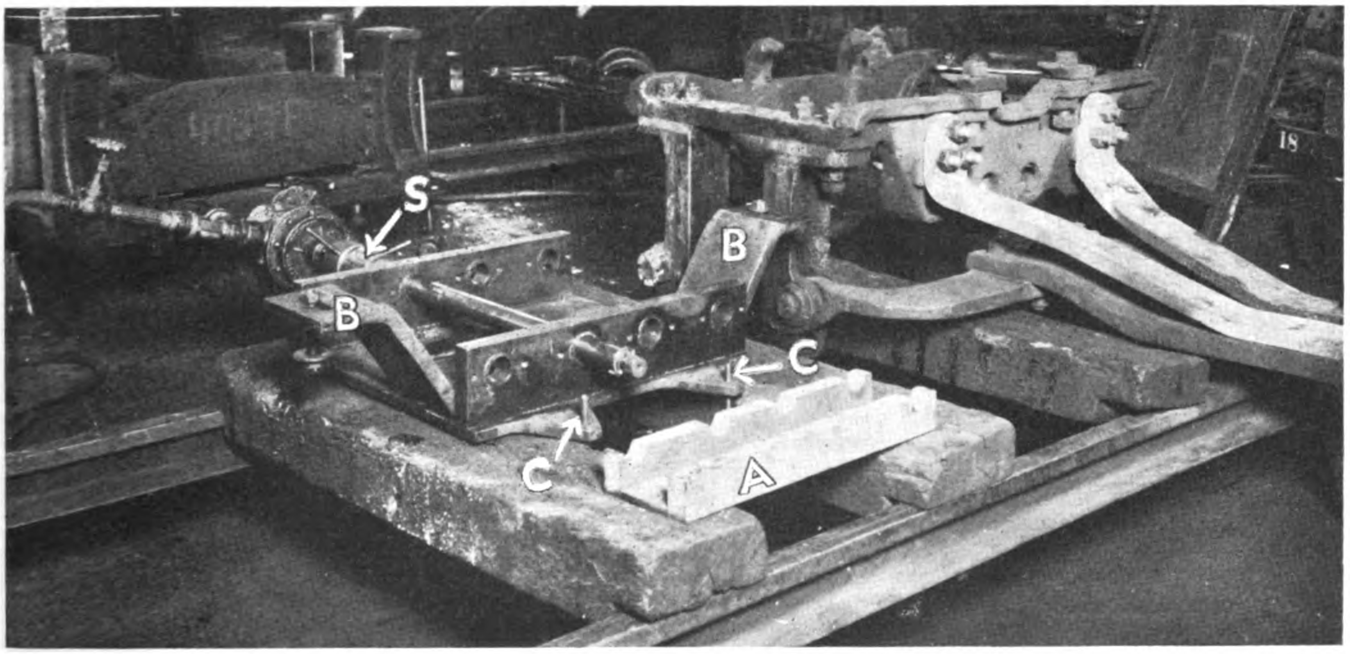
Reboring Swing-Link Seats

THE kind of repairs given to engine trucks in the backshop has an important bearing on the riding qualities of a locomotive, as well as on rail stress, flange wear, etc. With a view to repairing two-wheel engine trucks and returning them to service in as nearly as possible the same condition as when new, the swing-link seats in the main cast-steel frame are built up by welding at the Silvis (Ill.) shops of the Rock Island and re-machined to standard blueprint size and location by means of the jig shown in the illustrations.

In overhauling this type of truck, the cast-steel frame is cleaned, examined for cracks, excessive pedestal wear, if any, corrected, radius bars renewed, if necessary, and all parts tightly bolted. There are four holes, front and back, in the main frame to accommodate the swing-link pins which are subject to rather rapid wear, owing to the heavy pressures and impossibility of preventing abrasion due to excessive grit or dirt in this exposed location. Practically all of the wear occurs on the lower half of the holes, which are accordingly built up with the acetylene welding torch, using soft steel welding rod and the welding gage *A*, shown in one of the illustrations. This gage fits around the engine-truck casting and eliminates much of the guesswork in building up the worn part of the holes, leaving a little extra stock for machining.

The jig for re-machining the swing-link seats is shown in the same illustration, assembled as it would be after application to the engine truck and being used for the machining operation. The jig consists of a ¾-in. steel base plate, on which are mounted two narrow vertical plates, each of which has four 1¾-in. bronze-bushed holes, spaced according to the blueprint dimensions of the swing-link holes in the engine truck and accommodating a boring bar which is driven by an air motor. The boring bar is equipped with two 2-in. double-acting high-speed-steel cutters, enabling two holes to be bored at one time. Feed is obtained by means of a threaded sleeve *S*, which screws onto a bushing bolted on one of the vertical plates and better shown in the other illustration.

The jig is secured to the engine truck frame by two small bolts extending through the oil holes (journal box)



Welding gage *A* and jig for boring engine-truck swing-link seats, used at the Silvis shops of the Rock Island

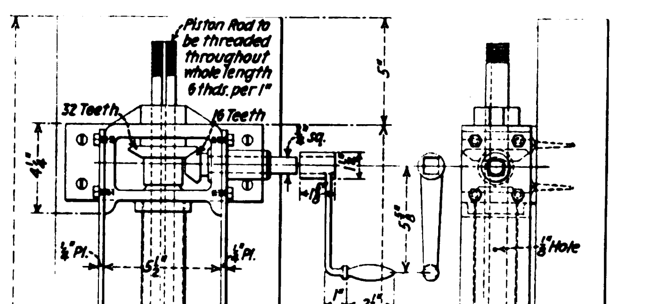
and the bracket *BB*, which is in turn fastened to the baseplate by six cap screws so that it can be removed from the base in assembling or taking down the jig. Four additional set screws, two of which are shown at *CC* in the base, can be tightened and thus assist in holding the jig rigid during the cutting operation. It will be observed that the bolt holes in the bracket *BB* are slotted, which permits the jig to bear against the back pedestal with varying widths of pedestal ways and thus take the thrust of the boring bar. Provision for centering the cutters is afforded by two steel taper pins which, at the same time, hold them tight.

The use of this jig assures not only that the swing link seats will be accurately machined in the right location, but that they will be in line in both the front and back sections of the casting and give a uniform bearing. One thing which has been noticed since this jig was used at Silvis shops is that swing-link seats built up and re-machined with this device apparently give a much longer service life than those machined in the original metal. In other words, they last for several shoppings, where, formerly, excessive wear developed in a single shopping period.

Hydraulic Testing Device For Globe and Angle Valves

WHEN it is desired to test globe or angle valves to pressures higher than those available in the backshop or enginehouse, the hydraulic testing device shown in the drawing can be used satisfactorily. It consists of a cylinder made of 2-in brass tubing in which a piston slides, actuated by a hand crank and suitable gearing. The piston rod is threaded throughout its entire length and is keyed to the top bracket to keep it from revolving as the gear, which actuates it, is turned by meshing with the beveled pinion gear keyed to the shaft of the hand crank.

The cylinder is supported by two vertical strips of



A hydraulic cylinder, the piston of which is operated by a hand crank, is used with the testing device to build up pressures beyond those available from regular shop sources

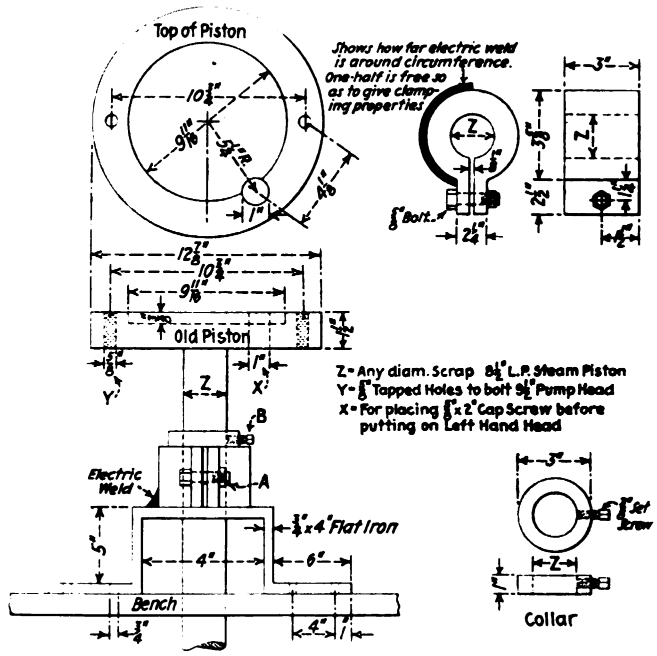
½-in. plate, 3¼-in. wide, which are bolted, top and bottom, to angles of ½-in. plate, the latter forming the brackets for supporting the device. Water is piped to the cylinder through an angle cock, which is shut off when sufficient water enters the cylinder. A globe valve is inserted between the cylinder and the coupling used to attach the valve being tested.

When using the device, the valve being tested is attached to the coupling and the globe valve opened. By turning the crank, forcing the piston downward, a pressure is built up behind the seat of the valve, the pressure being recorded on a single-hand gage which is coupled in the line between the cylinder and the globe valve.

Stand for Repairing Air-Compressor Heads

By E. G. Jones

THE repair stand shown in the drawing has many commendable features with respect to the repairing of 9½-in. air-compressor heads. By the adjustment of the collar on the stand rod, the stand can be raised or lowered to suit the convenience of the repairman. By this collar acting as a vertical thrust bearing, the stand,



Stand for repairing 9½-in. air-compressor heads

with the compressor head in place, can be revolved at will when the split clamp is loose. This feature is convenient in that the large and small head covers can be faced for 180 deg., the repairman to apply the bolts, simply by revolving the stand.

When the bolts are to be tightened, the split-clamp nut is turned with a wrench so as to clamp the stand rod which will hold the stand and head rigid.

Referring to the drawing, the head is bolted to the piston. The clamp nut *A* is loosened at the clamp and the piston is raised to the desired height. The nut *A* is then tightened. The collar rests on top of the clamp and is held by the set screw *B*. The loosening of the clamp nut *A* causes the weight to rest on the collar. The compressor head may then be turned to any position.

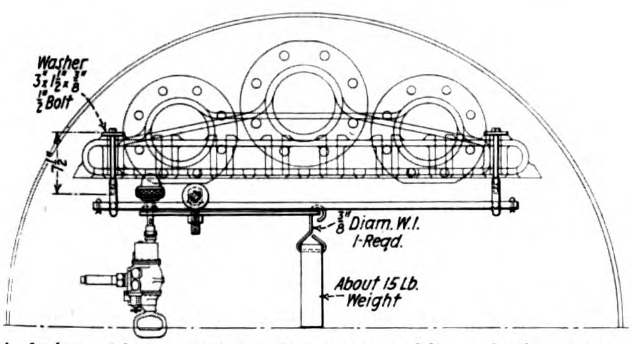
The stand is made of an old low-pressure steam piston and turned down in a lathe as shown. A recess is added

so as to permit a fit to the head shoulder when the compressor head is applied. A large hole is drilled in the stand head as shown so as to allow the pump-head bolt under the left main-valve cylinder head to remain in place. The compressor head is held rigidly to the stand head by two standard ⅝-in. cap bolts with tapped holes in the stand head.

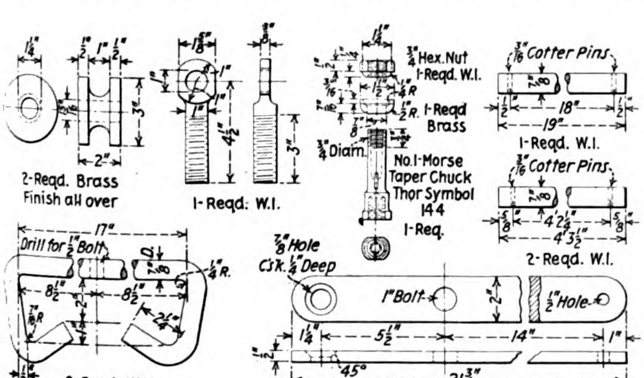
Device for Grinding Superheater Header Joints

WHEN grinding a complete set of superheater header joints in the smoke-box the mechanic frequently tires as a result of holding in a vertical position the small air motor used for operating the grinding tool. To eliminate the necessity of having the mechanic hold the air motor in the usual overhead position, the device shown in the drawing was designed to take the weight of the motor, thus permitting him to devote his entire attention to the quality of the joint.

The device consists of two rods suspended from the superheater header along which runs a pair of wheels, from the axle of which is suspended an I-bolt. The bolt serves as a fulcrum for a rod on one end of which is suspended a 15-lb. weight to balance the weight of the motor. Two ½-in. by 7½-in. bolts, held in position by 3-in. by 1½-in. by ⅜-in. washers, are used to suspend the device from the header. The bolts are directly attached to two hooks made of ⅞-in. round iron which in their finished shape are 17 in. long. This piece is bent in such a way as to support parallel bars, one at the front of the header and one at the back. The bars serve as runways for the pulley wheels which are connected by a ⅞-in. by 18-in. round bar, from which is suspended, by means of an I-bolt, the bar used to support the 15-lb. weight and air motor. This bar is a ½ in. thick, 2 in. wide and 21¾ in. long and has a ½-in. hole drilled at one end to serve as a means for inserting a ⅜-in. hook for supporting the 15-lb. weight. The other end of the bar is drilled and countersunk for the insertion of a long No. 1 Morse taper chuck, fitted with a brass bearing contoured to fit the counterbore. This bar is drilled 5½ in. from the end to which the motor is attached, for the insertion of the I-bolt suspended from the bar connecting the two pulley wheels. The ratio of the distance between the ends of the bar and the fulcrum point is about three to one to eliminate the necessity of hanging a weight in excess of 15 lb. at the end of the bar.



A device which supports the motor while grinding superheater header joints

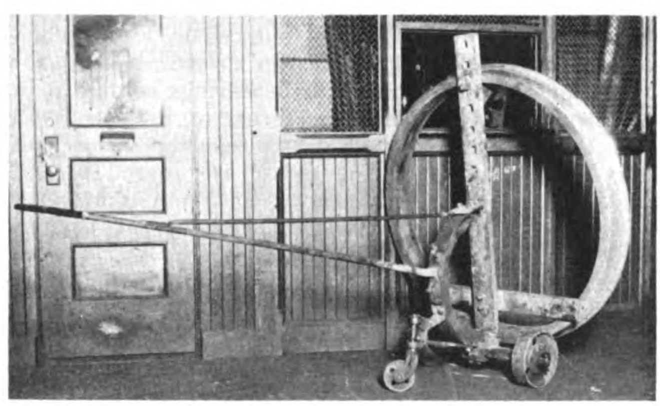


Details of the device which supports the motor during the grinding of superheater header joints

When in use the parallel rods are suspended in the manner described above, and the pulley wheels and bar for supporting the weight and motor are mounted in position. The motor, 15-lb. weight and the bar used to support them are assembled as a unit which can roll from one end of the header to the other. The assembled unit can thus be set in any position to reach all of the header unit joints without changing the setup.

Driving-Wheel Tire Wagon

A USEFUL wagon for hauling driving-wheel tires in and about an enginehouse and which can be used effectively in placing the tire against the wheel on which it is to be shrunk, is shown in the illustration. The wagon consists of an upright member mounted on an axle fitted with two 8-in. roller-bearing wheels. A semicircular brace, bolted to the axle and the middle of the upright member, is used to attach a swiveling trailing


A tire wagon which maneuvers a tire against a wheel without having to roll it

wheel, the use of which makes the wagon capable of supporting a tire in a vertical position without the necessity of steadying it with the tongue.

A cross bar is bolted near the bottom of the upright member and 2 in. above the top of the wheels. When a tire is placed on the wagon, it is supported by a hook, set in one of five square holes punched into the top of the upright member, and is kept away from the wheels by the cross bar at the bottom.

The important feature of the wagon is the small-diameter roller-bearing wheels. These permit the setting of a tire against an intermediate driving wheel without rolling it into position even though there might be considerable difficulty encountered because of obstructing parts of outside valve motion and its various supporting brackets.

NEW DEVICES

Pattern Millers for Small Shops

A MACHINE for milling patterns, which is designed to meet the particular needs of small pattern shops and which is designated as the Wadkin Junior pattern miller, W. K., has been introduced recently in this country by the Oliver Machinery Company, Grand Rapids, Mich. The machine is designed so that at least 90 per cent of all pattern and core-box work can be generated mechanically, being sufficiently flexible to give a combination of movements that will operate on geometric and irregular patterns. It offers a wide range of adjustments, quick-action fine-feed motions, and stops for automatically controlling the limits of the cutting. The machine is adaptable to a large variety of work and can be handled by the average workman.

The main frame is a heavy casting having machined slides which carry an overhanging arm. This arm carries the spindle head and is raised and lowered by hand motion through the medium of a worm and worm wheel and a large hand wheel placed in a convenient position on the arm. The distance between the center of the cutter spindle and the face of the body frame is 28 in. The spindle head swivels between the vertical and horizontal, the principal angles being indexed and located by a taper spring plunger engaging with suitable holes. Intermediate angles are registered by a scale graduated in degrees, and the head secured by a locking handle. When the spindle is in the horizontal position the maximum height between the cutter spindle and the work table is 18 in., which is reduced to 15 in. when the spindle is swivelled round into a vertical position.

The spindle runs in heavy ball bearings contained in dust-proof housings while the thrust of the spindle is taken by ball bearings arranged to take the thrust load only. The spindle and the chuck are forged in one piece and the chuck is bored to a No. 5 morse taper. A wide range of cutter holders and blocks, carrying various types of cutters, can be used to give the machine an extensive scope of working.

The spindle is fed into the work by a hand lever mounted in the center of the spindle head. This motion is arranged with a spring plunger to give definite depths of feed and is also provided with limit stops. This facilitates the operation of the machine, and is designed to prevent the possibility of spoiled work and to insure a higher degree of accuracy.

The drive is transmitted to the cutter spindle through the medium of a spindle running the full length of the arm. At the main-frame end is a pulley driven by belt from the motor pulley or the countershaft in the base of the main frame. The belt is arranged so that the raising and lowering of the arm does not affect the correct tension of the belt.

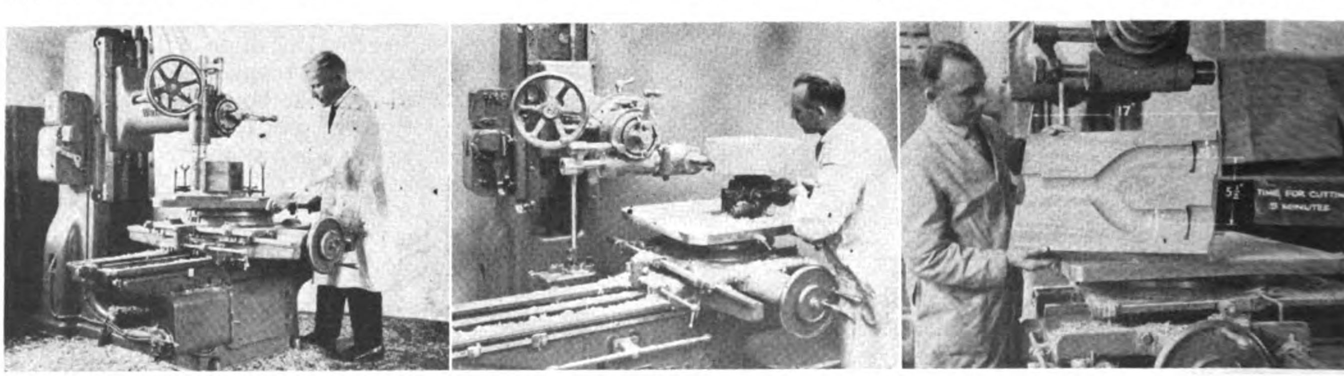
At the cutter-spindle head the drive is transmitted by spiral gears with ground teeth. These gears are totally inclosed and arranged to run in grease. This method of drive allows the spindle to drop below the level of the work to enter a core box with its axis parallel to the surface of the work. It also allows the cutters to be carried close to the bearings, dispensing with long boring bars. Another advantage is that this drive enables the spindle to occupy any angular position which often saves resetting the work and increases the range of the application of the cutters.

Two spindle speeds of 4,300 r.p.m. and 2,700 r.p.m., respectively, to suit the various sizes and types of cutters, are provided. These speeds are obtained either by means of a variable-speed motor when the machine is self-contained electrically-driven or, in the case of the belt-driven model, by a two-speed gear box connected to the main driving shaft.

The table is provided at regular intervals with tapped holes for securing adjustable holding-down clamps. It has two motions at right angles controlled by a screw and hand wheel, and also a rotary movement by a hand lever arranged with a spring-plunger taper pin engaging in holes giving all the principal angles. It has a longitudinal traverse movement of 44 in. and a lateral traverse movement of 22 in. These movements combined with the stop devices allow the cutters to operate on complicated forms and various radii semi-automatically.

General Electric Nitriding Furnaces

THE General Electric Company, Schenectady, N. Y., announces a complete line of batch-type nitriding furnaces for use at temperatures up to 1,200 deg. F. Included in the line are two sizes of vertical cylindrical-type furnaces, with a fan for circulating the ammonia gas, and two sizes of box-type furnaces, complete with charging trucks for handling the retorts.



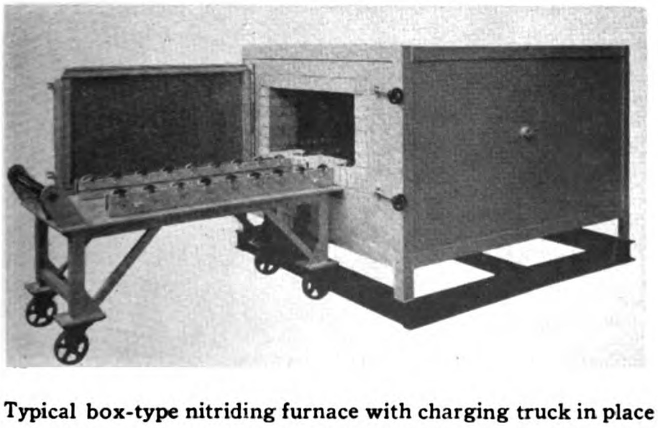
The Wadkin Junior pattern-milling machine which is designed to give a combination of movements that will generate geometric and irregular-shaped patterns—It is for use in small shops

The vertical-type furnaces consist of an outer shell containing the heating units of nickel-chromium resistor ribbon and an inner retort which is inserted into the furnace through a hole in the cover. The retort is made in two parts, the upper part containing the motor and fan and the lower part containing the charge to be nitrided. The fan is of the uni-directional high-pressure type and is used to insure complete diffusion of the ammonia gas through the charge. The upper half of the retort is part of the cover and is heavily insulated to keep the motor at operating temperature and to keep the radiation losses at a minimum. The lower part of the retort is an alloy-steel container, completely welded to be gas tight. A basket is provided for the charge and is supported within the retort. A close-fitting alloy steel hood covers the fan and fits down on the basket, thus guiding the circulation of gas through the charge.

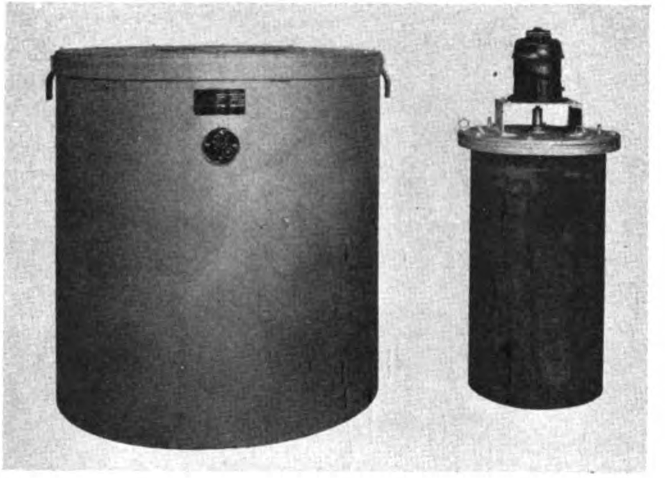
The two halves of the retort are joined securely together by means of bolts and nuts through metal rings attached to the outer circumference of each part. Gas leakage is prevented by means of a seal, consisting of an asbestos ring gasket compressed between the two rings. The inlet and outlet for the ammonia is through the cover, so that the complete retort can be withdrawn from the furnace at the end of the nitriding cycle and allowed to cool outside the furnace. The furnace can be recharged immediately by utilizing a spare retort or, in case the production does not warrant a second retort, the time of cooling is greatly reduced by permitting the charge to cool outside the furnace.

This furnace is available in two sizes. The smaller furnace has loading dimensions 14⅝ in. diameter by 18 in. in depth and is rated at 23 kw., 220 volts, 3 phase. The larger furnace has loading dimensions 20½ in. diameter by 26 in. depth and is rated at 30 kw., 220 volts, 3 phase.

The box-type furnaces are small and compact, requiring little head room and floor space. Light-weight refractory brick is used in the furnace and a simple swing-type door with screw clamps and an asbestos gasket to prevent heat leakage is provided. A rack and roller track is attached to the floor of the furnace to assure ready insertion and removal of the alloy-steel retort used to hold the charge. The cover of the retort is provided with a down-turned lip which engages in a groove provided around the top of the retort itself. The sealing medium for the retort is an asbestos and aluminum gasket compressed between the lip and groove by heavy bolts and nuts around the perimeter of the retort. Inlet and outlet tubes for the gas are of pure nickel tubing, extending through cone-shaped bushings in the back of the furnace. A charging truck, equipped with rack and rollers, can be supplied for handling the retort.



Typical box-type nitriding furnace with charging truck in place



Vertical cylindrical nitriding furnace with retort withdrawn

The furnace is available in two sizes, the larger being rated at 40 kw., 220 volts, 3 phase and having retort dimensions 28 in. wide by 48 in. long by 11 in. high. The smaller size is rated 30 kw., 220 volts, 3 phase, and has retort dimensions 19½ in. wide by 48 in. long by 11 in. high.

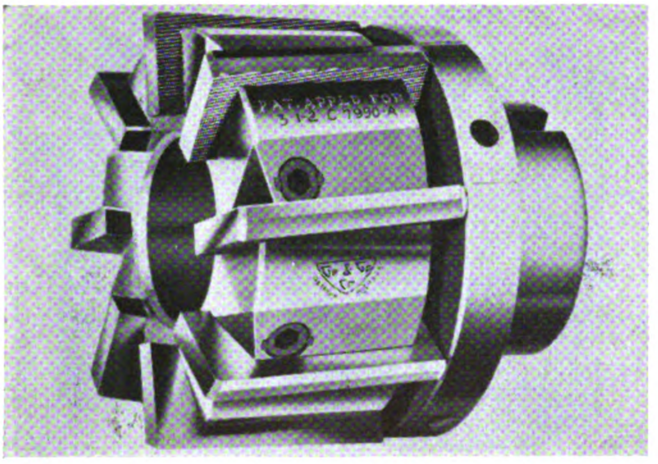
Because of the long holding cycles of the nitriding process where only the radiation losses of the furnace, plus the small amount of heat required to raise the temperature of the ammonia gas need be supplied, it is advisable to cut down the input to the furnace after the charge is up to temperature. The control panels of all General Electric nitriding furnaces are provided with a switch by means of which the input may be reduced to one-third of the rated value. A unit package containing all valves, gages, etc., all dissociation apparatus and glassware, mounted in a glass panelled steel cabinet, can be furnished with the furnaces.

Serrated-Blade Expansion Reamers

GODDARD & Goddard Company, Inc., Detroit, Mich., recently brought out a serrated-blade expansion finishing reamer which provides quick adjustment, positive positioning and long life of blades. The tool is an addition to the line of flat wedge-type reamers introduced about a year ago and meets the demand for a tool with quicker adjustment. The reamer consists of four component parts: An alloy heat-treated steel body, high-speed (or other cutting metal) blades, an adjusting nut, and a cam lock.

To make an adjustment of the cutters a set screw in the adjusting nut is loosened and the nut turned back one full turn. The blade cam lock is then released by turning the adjusting nut 90 deg. to the right. The blades are then slid back against the adjusting nut, after which the adjusting nut is turned against the blade until the required size is established. The cam lock is returned to its locking position by turning the adjusting nut 90 deg. to the left, after which it is clamped in position by tightening the set screw in the adjusting nut.

Blade adjustment for expansion is always toward the shank of the reamer as the blade slots are deepest at the reamer ends. As this longitudinal movement is only slightly more than 3/16 in. before the blade is moved out radially to the next serration and forward again to its initial position, the blades are held firmly in a large



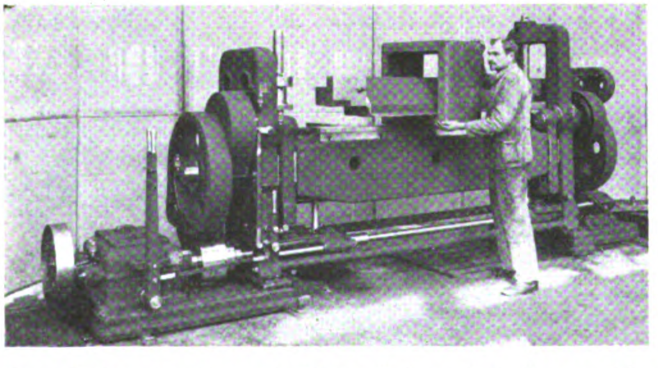
The Goddard & Goddard serrated-blade expansion finishing reamer

area contact with the body. Blades register at all times in the serrations and, as they do not contact at the bottom of the tooth slot, any blade can be replaced at any time by a new one without effect upon the remainder of the blades.

Long blade life is offered in this design, 1-in reamers allowing .187 in. expansion life, 2-in. reamers allowing .250 in., 3-in. reamers allowing .442 in. and 4½-in. reamers and over allowing .625 in. expansion life. Eight blade sizes are required for the entire standard finishing reamer range of 1 in. to 6 in. diameters. Shell, taper, and straight-shank blades are the three standard styles which are available. Standard blades can be used on certain special applications. The cam-lock feature can also be combined, on many special jobs, with the standard roughing reamer blades which have radial serrations (as compared with longitudinal serrations on standard finishing reamers). This is an application which can be used in combined reamers and spot facers, or reamers and chamfering tools or, as frequently is the case, in combinations of all three.

The Schatz Universal Brake

THE Universal brake, rounding and box forming machines recently placed on the market by the Schatz Manufacturing Company, Poughkeepsie, N. Y., are designed with either hand or power drive in widths from 40 in. to 20 ft. for handling plates, ranging from the thinnest to those 1⅛-in. thick. They can be had with or without a swing-out top clamping bar, the latter



One of the Schatz power-driven Universal brake-rounding and box-forming machines

being preferable for making closed forms, trays, boxes, tanks, etc., from one sheet of material.

Aside from the swing-out top bar feature, other characteristics include a high adjustment of the top clamping bar, which on the largest power machine goes to 25½ in., and the lowering of the bottom clamping bar and folding bar (apron) as much as 11¾ in. The high upward adjustment of the top bar permits the use of high-angle forming blades having a usable height of at least 80 per cent of the top-bar adjustment, for the forming of narrow channels, trays with high walls, besides the accommodation of bulky work between the bars.

The lowering of the bottom clamping bar and folding bar is resorted to when bends with a radius are made. The maximum radius that can be bent is equivalent to the maximum downward adjustment of the lower bars. These adjustments are made according to conveniently located graduated scales. The wide opening between the bars permits the introduction of round or rectangular mandrels, the former for tube forming or rounding and the latter for making smaller closed forms than can be made over the larger standard top bar.

The blades in the top bar can be readily interchanged without the use of screws or bolts of any kind. The blade in the folding bar is slotted for quick change and is reversible for folding or bending thick and thin plates. Boxes having wide or narrow inside or outside flanges can be formed from one sheet of metal, which is also an advantage on many other classes of work.

Grinder for Tungsten-Carbide Tools

A GRINDER, designed especially for sharpening tungsten-carbide and high-speed tools, which has been designated as the U. S. Tungsten-Carbide Tool Grinder, has recently been placed on the market by the

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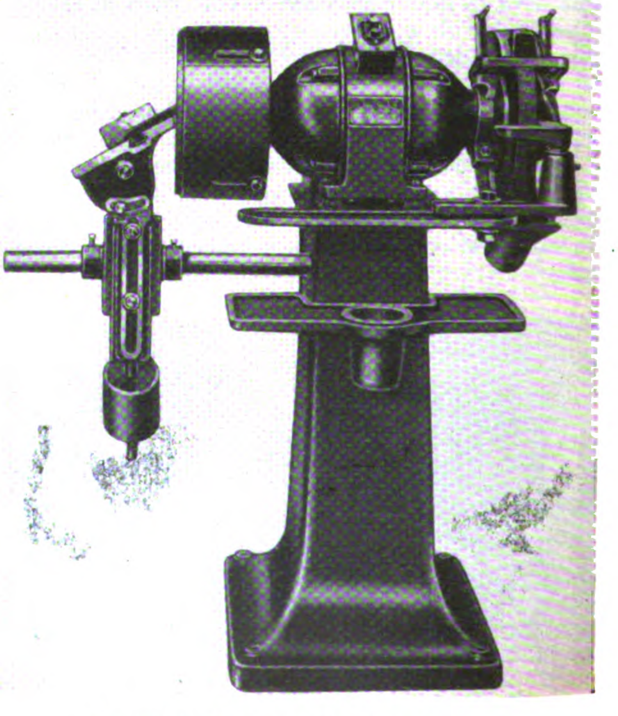
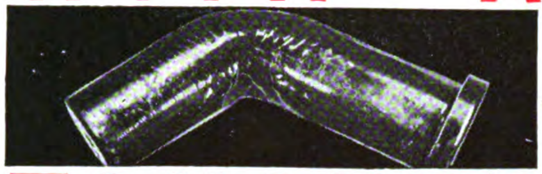


The U. S. Tungsten-Carbide grinder

A HARD CASE

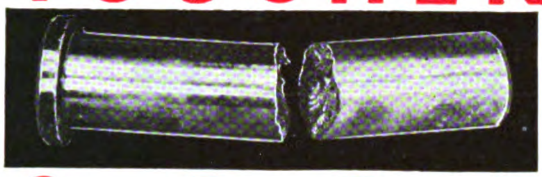
Wrought Iron

WITH A



Agathon Nickel Iron

TOUGHER



Steel

CORE

■ A hard case is worthless unless the core of a pin or bushing is sufficiently tough to withstand the shocks and stresses encountered in locomotive work.

■ Agathon Nickel Iron combines toughness of core with exceptional case-hardening qualities.

■ Agathon Nickel Iron is uniform all the way thru, with no slag seams lurking to spoil partly finished material.

■ Agathon Nickel Iron may be machined to size, polished, carburized and quenched from the pot without spoiling the surface for smoothness. Warping is practically negligible.

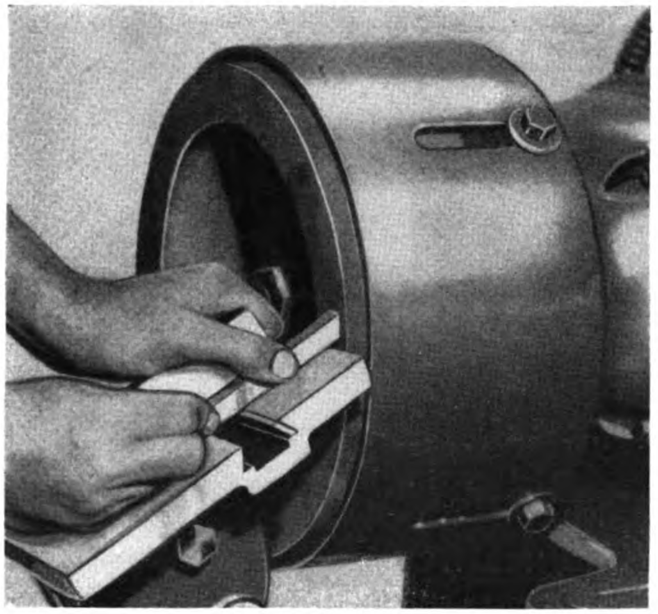
■ Try this modern alloy iron for all case-hardened pins and bushings.

AGATHON NICKEL IRON

Central Alloy Division

REPUBLIC STEEL CORPORATION

MASSILLON, OHIO



The cup wheel and adjustable table for grinding tungsten-carbide and high-speed tools

United States Electrical Tool Company, Cincinnati, Ohio. The tool rest of this machine is the outstanding feature. It is comprised of an adjustable table and a sliding guide which, together, hold the tool securely at any desired angle against the cup wheel. It is designed to prevent the mechanic from grinding away more of the tool than is necessary to sharpen it, and to grind a cutting edge on the tool which will prevent chattering and breaking away when in use. The tool rest is provided with a protractor in order that it might be set accurately at any desired angle for grinding the tools.

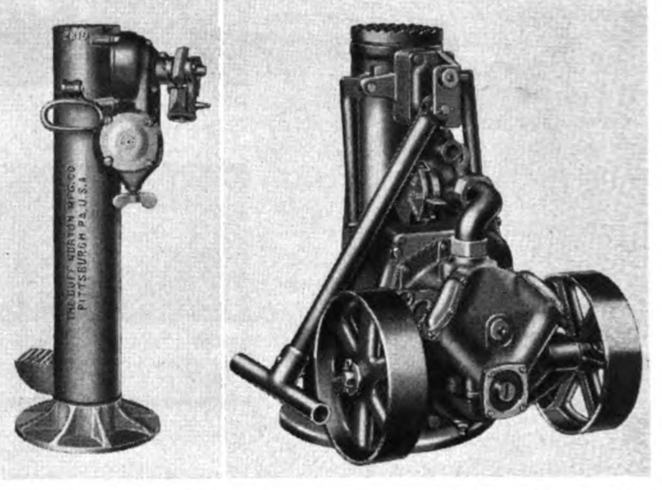
Other features of this machine include a 2-hp. motor which operates at a speed of 1,750 r.p.m. furnished in any standard a. c. or d. c. voltage; push-button control; SKF ball bearings, and a boiler-plate wheel guard which can be adjusted for wheel wear. The grinder can be furnished with a cup wheel and swinging table at one end and a conventional flat-face grinding wheel at the other end, as shown in the illustration, or with a cup wheel and swinging table at both ends.

Duff-Norton Jacks for Locomotives and Cars

IN the illustration is shown a 100-ton jack operated by an air-motor and a governor-controlled self-lowering jack which have been designed for engine-house and car-shop service, respectively. The 100-ton jack is mounted on wide-tread wheels and is equipped with a long collapsible trundling handle which folds out of the way when not in use. The load supported by the jack is carried on a phosphor-bronze nut, pressed and pinned into the end of the jack standard which is constructed of high-strength steel, made to metallurgical specifications. The top piece of the standard is of steel and is drop forged.

The 100-ton jack is equipped with an automatic shut-off device which operates when the standard reaches the safe limit of its lift or depth. It is also provided with an up-and-down throttle control, the lever of which is placed in a guarded position to prevent accidental movement. The bearing points of the valve controlling the operation of the air motor are lined with bronze bushings, while the steel parts are made of rustless, stainless steel; these being used to eliminate clogging and rusting of the air passages. In addition, a removable screen plug with a bronze screen is provided to prevent cinders and dirt from entering the motor. All the important parts of the jack are mounted on annular ball bearings, while those parts subjected to thrust as well as radial loads are mounted on Timken roller bearings.

The 100-ton jack, designed for heavy-duty locomotive service, weighs 415 lb., stands 26 in. high and has a lift of 14 in. The diameter of the base is 14 in., while the diameter of the head is 6⅛ in. With the



Left: The Duff-Norton governor-controlled self-lowering jack for empty-car maintenance service—Right: The 100-ton locomotive jack which is operated by an air motor and which is equipped with an automatic shut-off device

use of a Y air-hose connection, two of the jacks can be operated as a unit by one attendant.

The governor-controlled self-lowering jack is constructed with a one-piece shell and is designed especially for empty-car maintenance service. It is equipped with a toe lift for truck work, a control lever for lowering, Timken roller bearings, and self-lubricated working parts mounted in a grease-packed housing. The features of the jack are its fast lifting speed, its self-lowering quality, and the foot lift which facilitates spotting the jack when there is insufficient clearance for the load on the top of the jack. It weighs 109 lb., stands 28 in. high, and has a lift of 17 in. The base is 10 in. in diameter, while the diameter of the head is 4¾ in. Both jacks are recent developments of the Duff-Norton Manufacturing Company, Pittsburgh, Pa.

Portable Hand Grinder and Buffer

IN the illustration is shown a portable electrically driven hand grinder and buffer which has recently been placed on the market by the Standard Electrical Tool Company, Cincinnati, Ohio. The grinder is equipped with a ½-hp. General Electric Hy-Frequency motor for operating on 220-volt, 180-cycle, 3-phase current and is furnished with 6-in. by 1-in. high-speed Bakelite wheels which have a ⅝-in. bore. The speed of the

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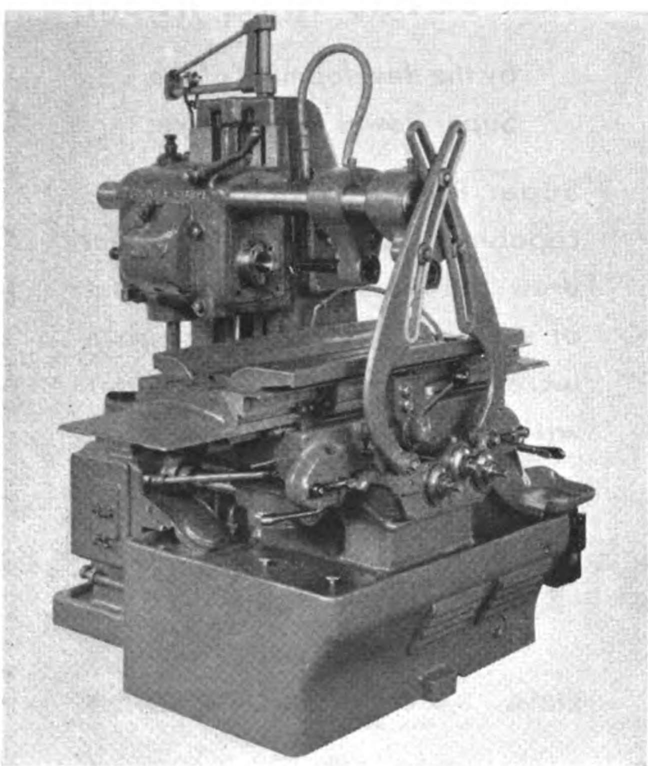
The Standard electrically driven hand grinder and buffer

grinding spindle is 5,400 r.p.m. The grinder is 26 in. long, is 4½ in. in diameter, weighs 20½ lb. and is fitted with SKF ball bearings which run in oil and which are mounted in dust-proof chambers. A trigger switch is employed to control the machine. Current is conveyed to the motor by means of a cable which is constructed by four wires, one of which is used for a ground.

Brown & Sharpe Plain Milling Machine

THE Brown & Sharpe Manufacturing Company, Providence, R. I., has developed a plain milling machine designed especially for short-run production work which has an automatic longitudinal feed of 22 in., a saddle transverse adjustment of 6 in., and a vertical adjustment of the spindle head of 13 in.

The most important feature of the machine, which the builder designates as its No. 22, is the control of all operating functions from the front. Speed changes, feed changes, hand longitudinal adjustment of the table, transverse adjustment of the saddle, vertical adjustment of the spindle head are each accomplished by a single lever. The spindle head is clamped rigidly in position by a single lever which also can be reached from the operating position.



The B. & S. No. 22 plain milling machine

The table is automatically controlled by means of adjustable dogs located at the front of the machine, several cycles of automatic operation being made available with the dogs furnished. Power travel and cutting feed for the table are available in both directions, while hand control by a single directional control lever on the front of the saddle is also provided.

The spindle is mounted on four anti-friction bearings and can be set to rotate either in a right-hand or a left-hand direction. It can also be set to rotate continuously or to stop simultaneously with the engagement of the power travel of the table and to start with the engagement of the cutting feed. When set for automatic operation, the directional control lever on the front of the saddle also controls the functioning of the spindle.

Anti-friction bearings are used throughout the machine and provision is made to adjust them for wear. Other features include automatic lubrication by filtered oil for all units in the base and driving unit; a pressure greasing system for the end bearings of the table drive shaft; a single oiling station for the saddle and table mechanism; wide chip spaces, and an automatic control for the cutter coolant, which is quickly returned to the coolant tank located in the base of the machine. The speed and feed change system used on the Brown & Sharpe standard milling machines is incorporated in the No. 22 machine, one turn in either direction of a single lever accomplishing a change in speed or feed. Sixteen spindle speeds, ranging in practically a geometric progression from 24 r.p.m. to 620 r.p.m., and sixteen feed changes from 1 in. to 38½ in. per min. are available. Direct reading dials above the levers indicate the speed or feed for which the machine is set.

The machine is of the unit assembly type of construction and is equipped with heat-treated alloy-steel gears and shafts and short rugged splined driving shafts.

The B. & S. No. 22 vertical milling attachment, the vertical milling attachment crane and the fixture flushing pump are furnished as extras when desired. The machine is built with a pad on the back of the column in order that the vertical attachment can be fastened to it when not in use. The crane provides a convenient and quick means for transferring the attachment to the face of the spindle head. The fixture flushing pump is used for flushing chips from the fixtures and the table. Coolant is available at all times when the machine is running, the flow of which is controlled by a spring plunger in the nozzle of the coolant supply pipe.

Cochrane-Bly Abrasive Cut-Off Machine

THE abrasive cut-off machine illustrated has recently been developed by the Cochrane-Bly Company, Rochester, N. Y., to increase the rate of cutting and the number of cuts for a given amount of wheel wear. The machine has a hardened and ground spindle mounted in dust-proof Timken roller bearings, and a heavy carriage mounted on ball-bearing ways which is moved to the work by means of a lever. The carriage is extended at the front underneath the knee and covers the ball-bearing ways, protecting them from grit.

The machine is driven through a four-speed gear box, having hardened nickel-steel gears running in oil and shafts mounted in Timken roller bearings. This gear

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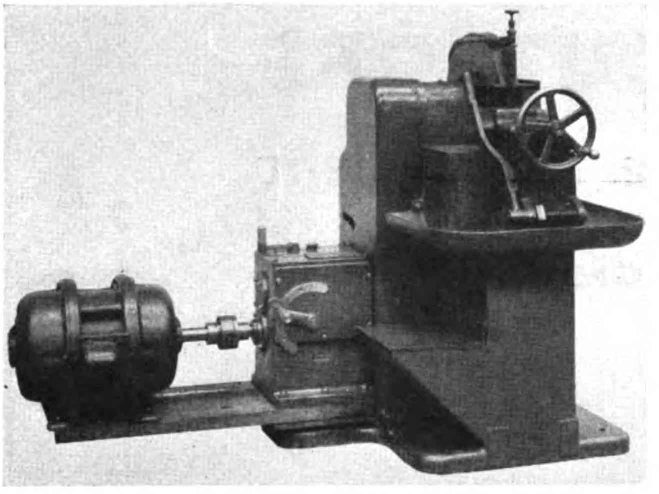


The Cochrane-Bly cut-off machine for wet and dry cutting

box provides four spindle speeds varying from 2,400 r.p.m. to 3,600 r.p.m., which give a periphery speed to the 16-in. abrasive wheel of 10,000 to 15,000 ft. per min. The machine can be speeded so that the speed changes compensate to a degree for the wear in the wheel diameter and maintain an approximately uniform periphery speed as the wheel wears down.

The machine is driven from the speed box to spindle by multiple V-belts. An idler pulley maintains uniform belt tension and compensates for any variation in centers of pulleys caused by carriage movement. It is designed

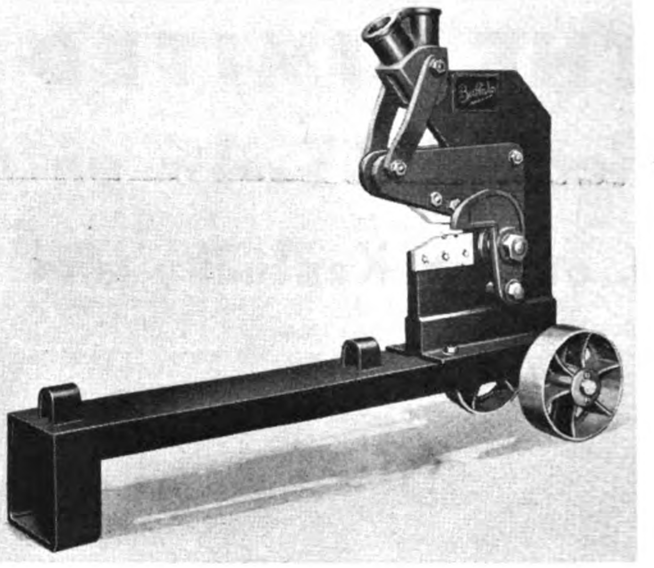
Specifications of the No. 21 Cochrane-Bly Abrasive Cut-Off Machine

Capacity, round stock	4 in.
Diameter abrasive wheel or saw	16 in.
Speed range of spindle	800-6,000 r.p.m.
Spindle speed for abrasive wheel	2,500-3,600 r.p.m.
Spindle speed for saw blade	800-3,600 r.p.m.
Spindle speed for friction disc	4,200-6,000 r.p.m.
Floor space, belt drive	38 in. by 40 in.
Floor space, motor drive (without speed box)	38 in. by 50 in.
Floor space, motor drive (with speed box)	38 in. by 68 in.
Net weight, belt drive, approx.	1,500 lb.
Motor required	15 hp.

for either wet or dry cutting and is provided with a pump which delivers a stream of coolant or lubricant to the wheel or saw blade. The wear of the wheel when cutting wet is just half the wear when cutting dry for a given number of cuts at the same rate. The machine is designed to cut cold-rolled bar, $1\frac{7}{16}$ in. round, in $2\frac{1}{2}$ sec. and 1-in. rounds or squares in about 1 sec. The machine can also be used with a saw blade for cutting non-ferrous metals, wood, fibre, bakelite, etc.

Buffalo No. 104 Armor-Plate Shears

THE Buffalo Forge Company, Buffalo, N. Y., recently added to its line of products the portable hand-operated armor-plate shears shown in the illustration. The armor-plate frame of the shears, from which the tool derives its name, is guaranteed to be unbreakable, while the all-steel truck and pipe handle are both designed for heavy-duty work. The pipe is used both as an operating handle for the shears and as a truck handle. The leverage system, which employs a double socket to permit convenient operation, is powerfully compounded and is designed with no working parts which can get out of order. A stripper on the side of the shears prevents binding.



The Buffalo No. 104 hand-operated shears which are truck mounted

The shears are capable of cutting flat bars 3 in. wide by ⅝ in. thick and can be fitted with special knives for cutting round stock 1 in. in diameter. The No. 104 shear illustrated is truck mounted and weighs 340 lb. The hand-operated shears can also be furnished in a bench type, which has the same capacities as the No. 104 shears and which weighs 250 lb.

Hyatt Oil-Seal Bushing

THE Hyatt Roller Bearing Company, Harrison, N. J., recently developed an oil-seal bushing for keeping the lubricant within its anti-friction journal box. It is designed to prevent the oil from escaping out of the

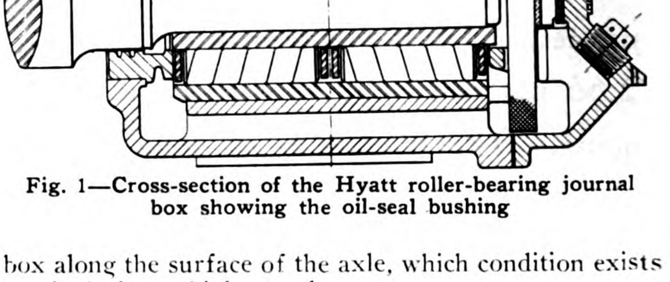


Fig. 1—Cross-section of the Hyatt roller-bearing journal box showing the oil-seal bushing

box along the surface of the axle, which condition exists particularly at high speeds.

Reference to Fig. 1 will show that, as the axle rotates within the bearing, oil is thrown off centrifugally from the sharp edge *A* machined on the axle. As the oil pressure builds up within the bearing, the oil can also

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ALWAYS PARALLEL

GOOD PIPE

GOOD SERVICE

Faster freight and passenger schedules, requiring higher operating efficiency, place a heavy responsibility upon the men who specify mechanical equipment. Experience shows that good service and good pipe go hand in hand.

NATIONAL Scale Free Pipe has been developed to eliminate choking of air-actuated equipment and clogging of small orifices in train lines. Clean, smooth pipe means full pressure in the lines and efficient operation of brake equipment.

Likewise, NATIONAL Copper-Steel Pipe—manufactured and used for nearly twenty years—prolongs the useful life of piping on locomotives and cars.

Bulletins Nos. 7 and 11 describe the Scale Free Process and the development of Copper-Steel Pipe. These two features have contributed in making NATIONAL—

America's Standard Wrought Pipe

NATIONAL TUBE COMPANY

Subsidiary of United States Steel Corporation

PITTSBURGH, PA.

US STEEL

NATIONAL PIPE

escape into the annular chamber *B*. The construction of this chamber is such that the oil drains downward into the sump and does not collect at the lower side of the axle. Likewise, oil drawn off at *A* drains downward into the sump from the horizontal center line and is not

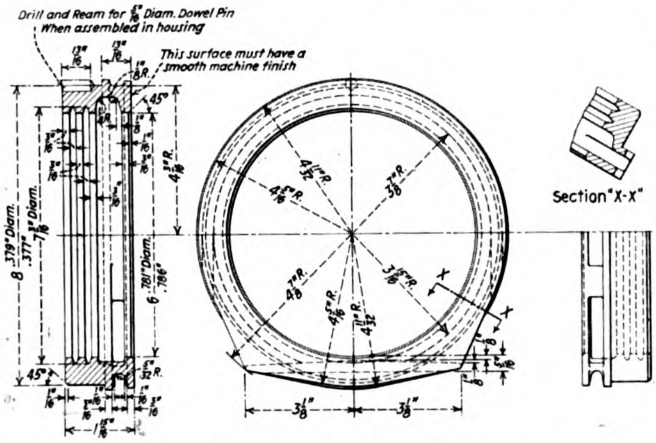
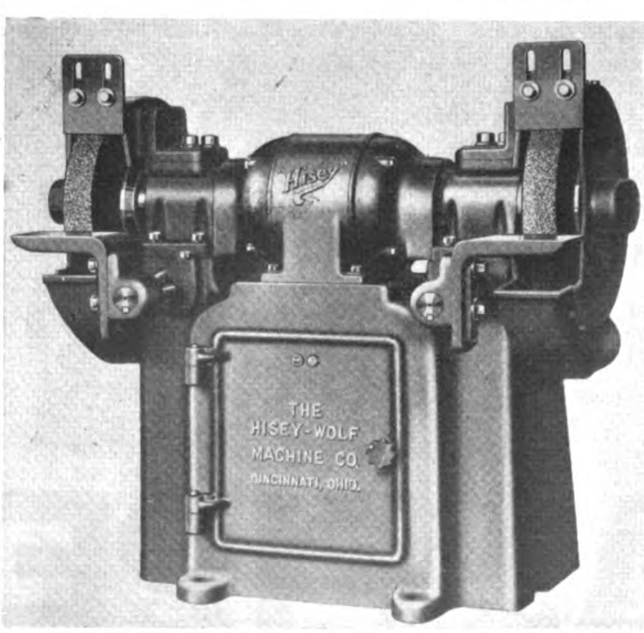


Fig. 2—Details of the Hyatt oil-seal bushing for a 6-in. by 11-in. journal box

permitted to collect below the axle, from where it would leak out. Side ports are provided in the oil-seal bushing to carry the oil back into the sump. The ledge built into the lower portion of the oil-seal bushing, as shown in Fig. 2, assists in deflecting the oil thrown off at *A* back into the sump. This action takes place regardless of the direction of the axle rotation. The ledge is also designed to confine to the sump any surging of the oil caused by the movement of the box.

Hisey Heavy-Duty Floor Grinders

THE Hisey-Wolf Machine Company, Cincinnati, Ohio, recently placed on the market a line of heavy-duty floor grinders with capacities of 5 hp., 7½ hp. and 10 hp. The grinders are similar to other Hisey grinders, but have the following improvements: Adjustable steel-plate guards, heavy steel grinding rests

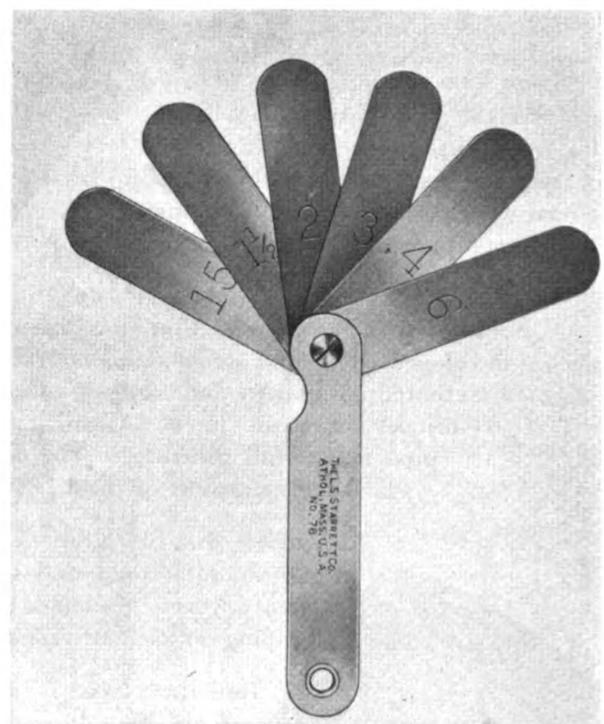


The Hisey 10-hp. heavy-duty floor grinder

which are adjustable and removable, a large door for access to the motor starter, a larger spindle, and larger bearings. All the feed wires are encased in flexible metal conduit. The 5-hp. capacity machine has 3-in. by 18-in. wheels, a no-load speed of 140 r.p.m., measures 43 in. between centers and 34½ in. from the floor to the spindle and has a net weight of 1,650. The 7½-hp. machine has 4-in. by 20-in. wheels, and a no-load speed of 1,140 r.p.m. It measures 44 in. between wheel centers, 34½ in. from the floor to the spindle and weighs 1,800 lb. The 10-hp. grinder has 4-in. by 24-in. wheels and a no-load speed of 900 r.p.m. It weighs 2,000 lb. and measures 44 in. between wheel centers and 34½ in. from the floor to the spindle.

Starrett No. 78 Thickness Gage

IN the illustration is shown a thickness gage, the six leaves of which are .0015 in., .002 in., .003 in., .004 in., .006 in., and .015 in. thick, respectively, giving a range by thousandths from .0015 in. to .031 in. The



The Starrett No. 78 six-leaf thickness gage

gage is the product of the L. S. Starrett Company, Athol, Mass., and is designated as that company's No. 78 gage. The leaves are protected by a steel case, held by a screw-and-stud arrangement which allows them to be replaced when damaged. An eyelet in the end of the case allows the gages to be carried on a ring and, since it is less than 3 in. long, it fits readily in a pocket.

FIFTY YEARS AGO.—The Philadelphia & Reading [now the Reading] has just placed in service a locomotive with a Wooten type firebox which has an inside width of 8 ft. and a grate area of 76 sq. ft. The wheel arrangement is that of the Consolidation type locomotive with the firebox located above and to the rear of the rear pair of driving wheels and the cab above and on each side of the boiler.—*Railroad Gazette*, September 17, 1880.

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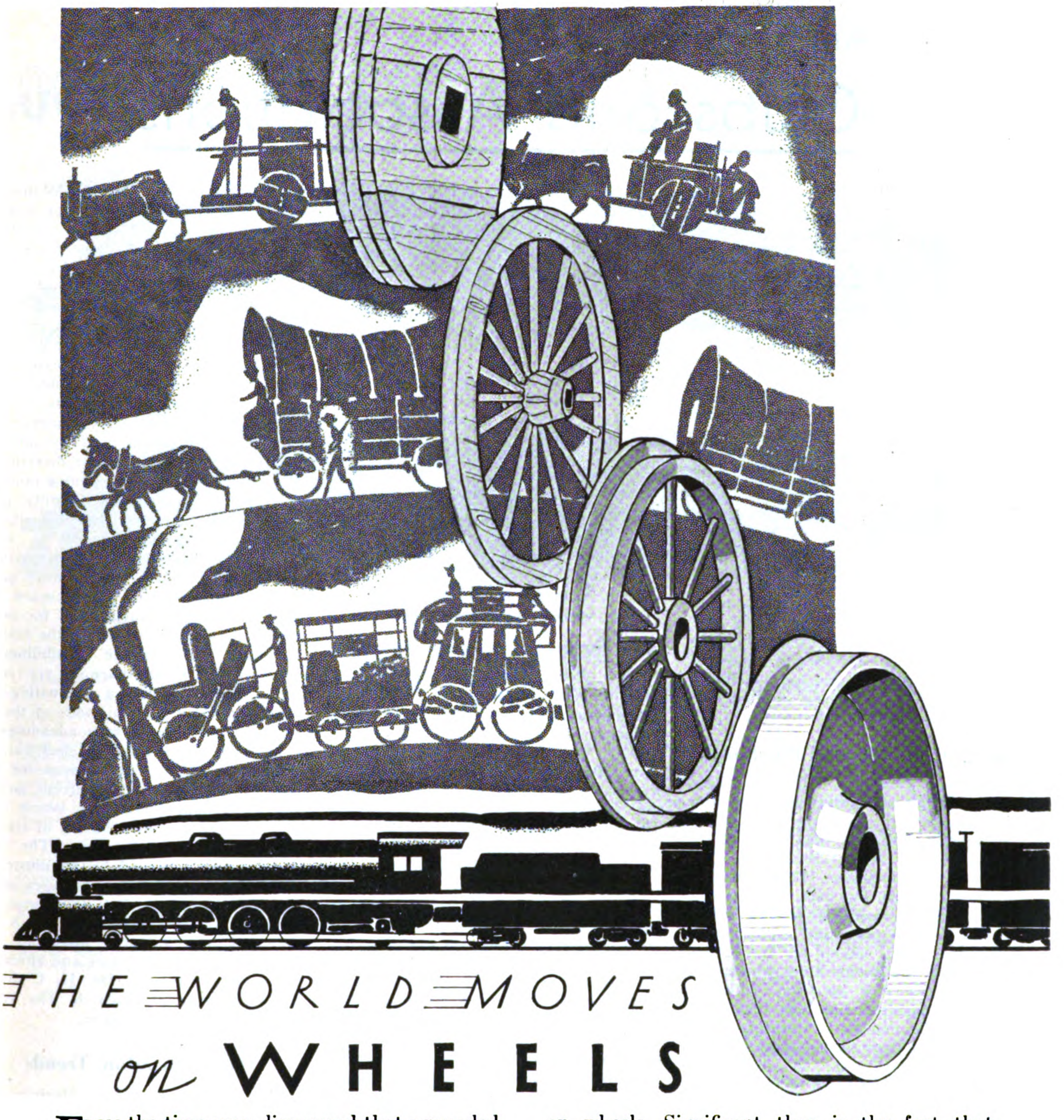

Among the
Clubs and Associations

NEW YORK RAILROAD CLUB.—G. E. Doke, president and secretary of the Association of Manufacturers of Chilled Car Wheels, Chicago, will dsicuss chilled iron car wheels at the April 17 meeting of the New York Railroad Club which will be held at 8 p.m. at the Engineering Societies building, 29 West Thirty-Ninth street, New York. Stereopticon slide and motion pictures will also be presented.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Papers on the Practical Application of Alloy Steel to Locomotives and the Theoretical Application of Alloy Steel to Locomotives will be presented by C. E. Barba, mechanical engineer of the Boston & Maine, and A. E. White, professor metallurgical engineering, University of Michigan, respectively, at the session of the Railroad Division of the American Society of Mechanical Engineers to be held during the spring meeting of the society, April 20, at the Tutwiler Hotel, Birmingham, Ala. The other sessions during the spring meeting, April 20-23, will be devoted to discussions of subjects of interest to other divisions of the society.

A. S. T. M. Meets at Pittsburgh

American Society for Testing Materials.—The annual spring group meeting of committees of the American Society for Testing Materials was held at the Hotel William Penn, Pittsburgh, Pa., March 16 to 20, inclusive. The committees met throughout all five days, starting with sessions in the morning and extending through the afternoon and evening with but one break—a dinner on Wednesday evening. In all, twenty-three committees of the society took part but, with the many sub-committee meetings that were necessary, the number of meetings held during the five days totaled approximately 115. About 500 were in attendance. Following is a selected list of the subjects discussed: Committee A-1 on Steel; A-2 on Wrought Iron; A-3 on Cast Iron; Sub-Committee II of A-4 on Heat Treatment of Iron and Steel Castings; A-5 on Corrosion of Iron and Steel; A-7 on Malleable Castings; A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys; Sub-Committee II of B-5 on Cast Metals and Alloys; Sub-Committee of E-1 on Tension Testing; Sub-Committee of E-1 on Effect of Speed of Testing; Sub-Committee of E-1 on Impact Testing; Sub-Committee of E-1 on Elastic Strength of Materials; Technical Committee of E-1 on Presentation of Data; Research Committee on Fatigue of Metals; Sub-Committee I of Sectional Committee on Wrought-Iron and Wrought-Steel Pipe and Tubing; Sectional Committee on Zinc Coating of Iron and Steel; Sectional Committee on Specifications for Fuel Oils (including Diesel fuel), and Sectional Committee on Classification of Coals. ¶In addition, a joint meeting was held of the Committee on Exposure Tests, composed of representatives of Committee A-5 and the American Electroplaters' Society. ¶The group meeting was held in conjunction with the Pittsburgh regional meeting, comprising a symposium on welding, arranged under the joint auspices of the Pittsburgh District Committee and the Pittsburgh Section of the American Welding Society. The symposium consisted of two sessions, the morning session covering a general survey of welding, its history and applications, while the afternoon session discussed the inspection and testing of welding and welded products.

Club Papers

The Future of Electric Traction

The New York Railroad Club—Meeting held February 20, 1931, at the Engineering Societies Building, 29 West 39 street, New York City. Papers by Sidney Withington, electrical engineer, New York, New Haven & Hartford Railroad and by F. H. Shepard, director of heavy traction, Westinghouse Electric & Manufacturing Co. ¶Thirty-five years' experience with heavy electric traction were reviewed briefly by Mr. Withington. In the course of his address he indicated the need and pointed out the possibility of establishing a unified distribution system for all electrified lines. ¶"A new era," he said, "has been opened by the Pennsylvania in undertaking a project not made necessary by legislative action or by some special problem of grades or tunnels, but which project was undertaken because it was foreseen that the traffic demands upon the Pennsylvania lines will greatly increase in the not distant future and it is believed that electric power is the best tool to use in meeting these demands." ¶In outlining the experience of the New Haven, Mr. Withington cited some of the more important developments which had been made. These included the present form of contact system using a bronze contact wire, large steam-turbine-driven single-phase generators, a selective system of circuit-breaker protection, the gearless single-phase locomotive, and current-collecting devices which will collect current from an overhead contact wire, an overhead third rail or from an under-running third rail located alternately on either side of the track. Pantographs were developed which would successfully collect alternating current from an overhead wire at 80 miles an hour. ¶Mr. Withington said that the most important problem which now required solution is "What electric system is the best for general use for heavy main line electrification in the United States?" In this connection, he said: ¶"It is sincerely to be hoped that this important question will be answered before long. With the growth of railroad electrification, the necessity will arise for the interchance of equipment among railroads, and unless a system of power distribution can be agreed to as standard by the railroads of the country, the diversity of electrical characteristics among railroads is going to be a major calamity, comparable perhaps to the diversity in track gage which caused so much trouble and loss in the early days of railroading." ¶Mr. Withington's paper was supplemented by Mr. Shepard who gave a number of suggestions for future electrification. "Looking to the future," he said, "the ultimate possibilities of railroad electrification are not yet visualized. With the use of alternating-current equipment, the railroads of the future will be able to take advantage of every trend indicated in electrical development today. The reason for this is that with alternating-current motors and equipment there need be no limit as to source and distribution of electric power for railroad use. ¶The two papers were followed by an illustrated discussion of the industrial uses of x-rays by Harold G. Petsing, educational director of the Westinghouse X-Ray Co., and an illustrated discussion and demonstration of the uses and effects of ultra violet rays by Dr. H. C. Rentschler, director of research, The Westinghouse Lamp Company.

Transportation Trends

Western Railway Club.—Meeting held March 16 at Chicago. Addresses by F. W. Robinson, vice-president, Union Pacific system, on the subject, "The Changing Times;" and by J. E. Buker, vice-president, Vapor Car Heating Company, on the subject, "Transportation." ¶Mr. Buker's paper stressed the decline in railroad traffic, with consequent curtailment of expenses and maintenance work, and urged railroad men as well as supply company representatives to use rail service exclusively when on business and to emphasize the advantages of steam rail service when talking to friends who are prospective travelers or shippers. Mr. Robinson discussed the traffic loss to the railroads, due to the rapid extension of gasoline pipe lines, automobile buses and trucks and intercoastal steamship service

(Continued on next left-hand page)

through the Panama canal. Regarding unregulated competition, which constitutes the principal problem now confronting the railways, Mr. Robinson spoke as follows: ¶"The foregoing outline of these competitive features with which western railroads are confronted is indicative of the serious situation and is in a large part, if not almost entirely, the answer as to what is the trouble with their traffic. Railroad men do not complain of fair competition. They do protest against unfair competition. The railroads are subject to the most rigid regulation of any industry. Their competitors are entirely free agents. Until a public sentiment is aroused to the necessity of a correction being applied to these unregulated forms of competition, there will not be much improvement in the revenues of western carriers. ¶"In the meantime, neither traffic nor operating officers of the western carriers are wholly idle. Steps are being taken to meet, so far as we can, some of this competition. We look forward to some constructive action on the part of legislatures now in session, with regard to some form of regulation of automobile, bus and truck competition. It may or may not occur. We do look for and reasonably anticipate a more liberal attitude on the part of the regulatory bodies. Possibly some relief will be granted from the drastic rate reductions which have been ordered. We are seeking and hope to secure some relief from the bad practice of ordering reparations, running back for several years in many cases, and these reparation orders occasionally applying to rates which the commission, itself, has heretofore prescribed as reasonable maximum rates. ¶"This outline is given, not in a pessimistic frame of mind, but rather as a recital of the facts and conditions as they actually prevail. There has ever been a resourcefulness and initiative on the part of railroad traffic officers which may be temporarily stunned by the succession of blows recently received, but certainly it is far from being dead. The American public has an innate sense of fair play and is generally in sympathy with the under dog, a term which may well be applied to the traffic of the western railroads at the present time. Railroad men as a class are good citizens. They are engaged in a constructive industry, one that is an essential and integral part of the industry activity of this nation. They are forward-looking men who deserve and command the respect of the public, and I have sincere confidence that these many problems will be fairly adjusted for all of the interests concerned. This is not going to be accomplished, of course, by merely wishing it on the part of railroad employers, but can be gained only through the intelligent and fair presentation of their problems to the public and to congressional representatives having to do with legislative matters. ¶"There is something for you as an organization to do in this matter. There is something for the business interests of this country to do about it, and there is something for the vast army of stockholders of these many railroads to do about it in their own investment interests."

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

Air-Brake Association.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

American Railway Association.—Division V.—Mechanical.—V. R. Hawthorne, 59 East Van Buren street, Chicago. Meeting June 23, 24 and 25, Congress Hotel, Chicago.

Division V.—Equipment Painting Section.—V. R. Hawthorne, Chicago.

Division VI.—Purchases and Stores.—W. J. Farrell, 30 Vesey street, New York. Next meeting May 19, 20, 21, Biltmore hotel, Atlanta, Ga.

Division I. — Safety Section. — J. C. Caviston, 30 Vesey street, New York.

Division VIII.—Car Service Division.—C. A. Buch, Seventeenth and H streets, Washington, D. C.

American Railway Tool Foremen's Association.—G. G. Macina, 11402 Calumet avenue, Chicago.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.

Railroad Division.—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York. Spring meeting April 20-23, Birmingham, Ala.

Machine Shop Practice Division. — Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.

Materials Handling Division.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.

Oil and Gas Power Division.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.

Fuels Division.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

American Society for Steel Treating.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

American Society for Testing Materials.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa

American Welding Society.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

Association of Railway Electrical Engineers.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

Association of Railway Supply Men.—J. W. Fogg, MacLean-Fogg Lock Nut Company, 2649 N. Kildar avenue, Chicago. Meets with International Railway General Foremen's Association.

Boiler Maker's Supply Men's Association.—Frank C. Hasse, Oxweld Railroad Service Company, 230 N. Michigan avenue, Chicago. Meets with Master Boiler Makers' Assoc.

Canadian Railway Club.—C. R. Crook, 2276 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month except in June, July and August, at Windsor Hotel, Montreal, Que.

Car Department Officers Association.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

Car Foremen's Association of Chicago.—G. K. Oliver, 2514 West Fifty-Fifth street Chicago. Regular meeting, second Monday in each month, except June, July and August, Great Northern Hotel, Chicago, Ill.

Car Foremen's Club of Los Angeles.—J. W. Krause, 608 South Main street, Los Angeles, Cal. Meetings second Monday of each month except July, August and September, in the Pacific Electric Club building, Los Angeles, Cal.

Car Foreman's Association of Omaha, Council Bluffs and South Omaha Interchange.—Geo. Kriegler, car foreman, Chicago, Burlington & Quincy, Sixteenth avenue and Sixth streets, Council Bluffs, Iowa. Regular meetings, second Thursday of each month at Council Bluffs.

Car Foremen's Association of St. Louis.—F. G. Weigman, 720 North Twenty-third street, East St. Louis, Ill. Regular meeting first Tuesday in each month, except July and August, at American Hotel Annex, St. Louis, Mo.

Central Railway Club of Buffalo.—T. J. O'Donnell, executive secretary, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meeting, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

Cincinnati Railway Club.—D. R. Boyd, 453 East Sixth street, Cincinnati. Regular meeting second Tuesday, February, May, September and November.

Cleveland Railway Club.—F. L. Frericks, 14416 Adler avenue, Cleveland, Ohio. Meeting second Monday each month, except July, August and September, at the Auditorium, Brotherhood of Railroad Trainmen's building, West Ninth and Superior avenue, Cleveland.

Eastern Car Foremen's Association.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings fourth Friday of each month, except June, July, August and September.

Indianapolis Car Inspection Association.—E. A. Jackson, Box 22, Mail Room, Union Station, Indianapolis, Ind. Regular meetings first Monday of each month at Hotel Severin, Indianapolis, at 7 p.m. Noon-day luncheon 12:15 p.m. for Executive Committee and men interested car department.

International Railroad Master Blacksmith's Association.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

International Railroad Master Blacksmith's Supply Men's Association.—J. H. Jones, Crucible Steel Company, of America, 650 Washington boulevard, Chicago.

International Railway Fuel Association.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago.

International Railway General Foremen's Association.—William Hall, 1061 W. Wabash street, Winona, Minn.

International Railway Supply Men's Association.—W. J. Dickinson, acting secretary, 1703 Fisher building, Chicago. Meets with International Railway Fuel Association.

Louisiana Car Department Association.—L. Brownlee, 3730 South Prieur street, New Orleans, La. Meetings third Thursday.

Master Boilermaker's Association. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

Master Car Builders' and Supervisors' Association.—See Car Department Officers Association.

National Safety Council—Steam Railroad Section: W. A. Booth, Canadian National, Montreal, Que. William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

New England Railroad Club.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting, second Tuesday in each month, excepting June, July, August and September. Copley-Plaza Hotel, Boston.

New York Railroad Club.—Douglas I. McKay, executive secretary, 26 Cortlandt street, New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York.

Pacific Railway Club.—W. S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

Pueblo Car Men's Association.—I. F. Wharton, chief clerk, Interchange Bureau, Pueblo, Colo.

Railway Business Association. — Frank W. Noxon, 1124 Woodward building, Washington, D. C.

Railway Car Men's Club of Peoria and Pekin.—C. L. Roberts, chief clerk, Peoria & Pekin Union Railway, 217 Lydia avenue, Peoria, Ill.

Railway Club of Greenville.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meetings third Tuesday of each month, except June, July and August.

Railway Club of Pittsburgh.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Regular Meeting fourth Thursday in month, except June, July and August. Ft. Pitt Hotel, Pittsburgh, Pa.

Railway Equipment Manufacturers' Association.—F. W. Venton, Crane Company, 836 South Michigan avenue, Chicago. Meets with Traveling Engineers' Association.

Railway Fire Protection Association.—R. R. Hackett, Baltimore & Ohio, Baltimore, Md.

Railway Supply Manufacturers' Association.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

St. Louis Railway Club.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

Southern and Southwestern Railway Club.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, June, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

Supply Men's Association. — E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division, American Railway Association.

Supply Men's Association.—Bradley S. Johnson, W. H. Miner, Inc., Chicago. Meets with Car Department Officers Association.

Traveling Engineers' Association. — W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio.

Western Railway Club.—W. J. Dickinson, 343 South Dearborn street, Chicago. Regular meetings, third Monday in each month.

NEWS

Westinghouse Tests Stream-Lined Car Models

IN A SERIES OF TESTS with scale models of present type and stream-lined cars in winds of varying velocities up to 80 m.p.h., Dr. Oscar G. Tietjens of the Research

Dr. Oscar G. Tietjens with stream-line model of a railway motor car

Laboratory, Westinghouse Electric & Manufacturing Company, has developed a number of conclusions which are believed to be correct within a close percentage when applied to full size equipment.

In the case of a heavy locomotive and two heavy coaches, stream-line design saves 13 per cent of the required total horsepower for a speed of 35 m.p.h. and 32 per cent of the total horsepower required for a speed of 75 m.p.h., in present equipment of similar weight.

It requires 286 hp. to drive the present type of light interurban electric car at 80 m.p.h. Tests, made in the Westinghouse wind tunnel, indicated that the same type of car of stream-line design can be driven 80 m.p.h. with only 140 hp., thus saving 146 hp. At 35 m.p.h., stream-lining will save 30 per cent of the horsepower required for a similar car of the present shape and at a speed of 75 to 80 m.p.h., such a car will travel with one-half the horsepower required to send the present car at that speed.

According to Dr. Tietjens' tests, stream-lining is not so important for the slower speeds or for heavy equipment, although it is of benefit at high speeds and particularly for light equipment. As the weight can be decreased, journal friction is reduced, which explains the advantage that goes to lighter rolling stock. From these results, Dr. Tietjens concludes that stream-lining will be worth while for medium and high-speed light interurban cars and for heavy high-speed trains.

Dr. Tietjens states that for an ordinary locomotive the potential benefit is sixteen times greater than the same coefficient for a stream-lined zeppelin of the same cross-sectional area.

From this entire program of activity, it is expected to work out new styles in high-speed cars and trains that will be revolutionary in character and appearance as well as notable for their efficiency and economy of operation. It is believed that Dr. Tietjens' tests in the Westinghouse Research Laboratories open up a new field of possibilities in operating trains and cars faster than at present without increased energy or fuel requirements.

Fuel Performance on the Frisco

THE ST. LOUIS-SAN FRANCISCO reduced its fuel consumption for freight service during January to 167 lb. per 1,000 gross ton-miles, as compared with 210 lb. per 1,000 gross ton-miles in January, 1930. In passenger service, the fuel consumed in January was 15.6 lb. per passenger car-mile, a reduction of 16 per cent, as compared with the same month last year. In switching service the pounds of fuel per switching locomotive-mile decreased 7.74 per cent. The saving in fuel for January, 1931, as contrasted with the same month in 1930, is equivalent to approximately 25,000 tons of coal or 500 carloads. During the first month of 1931, the average freight-train load was 1,403 tons, while in January, 1930, it was 1,281.

This performance is a continuation of the results secured for the 12 months of 1930 when the fuel consumed in freight service, 163 lb. per 1,000 gross ton-miles, established a new record for the system. The figure for 1930 likewise represented an improvement over 1929 when the amount was 170 lb. per 1,000 gross ton-miles. In 1920, the total was 255 lb. per 1,000 gross ton-miles. The pounds of fuel per passenger car-mile in 1930 totaled 15.2 which was equal to the 1929 performance. In switching service the fuel per locomotive-mile average 144 lb., equalling the performance for 1929.

Enginemen Ask I.C.C. To Require Mechanical Stokers

HEARINGS on the complaint filed by the Brotherhood of Locomotive Firemen and Enginemen and the Brotherhood of Locomotive Engineers asking the Interstate Commerce Commission to require that steam locomotives generally be equipped with mechanical stokers were begun at Washington on March 24 before Special Examiner J. L. Rogers. A large number of enginemen from various roads, including many demoted engineers, were on hand to testify and it is expected that the hearing will last for several weeks. Although the complaint was based on the ground that the stokers are required for safety, some of the first witnesses who testified mentioned particularly that with stoker-fired locomotives they would be "in shape" to enjoy social affairs in the evening. They had emphasized the arduous work of hand-firing and averred that on a heavy run their duties with the scoop often interfered with the observance of signals and other duties. Some witnesses expressed the opinion that a ton of coal an hour was a reasonable amount for a man to handle, although they spoke of shoveling anywhere from 10 to 26 tons of coal on a run. One witness told of handling 20 to 26 tons of coal on a 140-mile freight run that often ran up to the 16-hour

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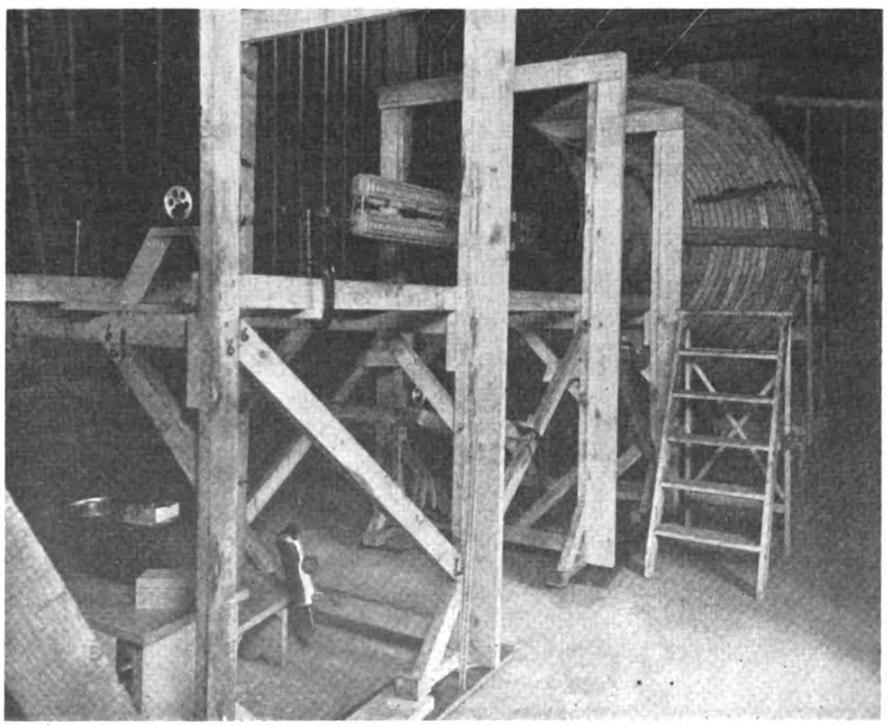

Wind tunnel in the research laboratories of the Westinghouse Electric & Manufacturing Company

limit but said that now on the same run, with a stoker-fired locomotive, the tonnage is increased and the run is generally completed before overtime begins. He said that after 16 hours of hand-firing he often felt "played-out, cooked out and burned out and lucky to get home without help," but that now, after eleven hours on a stoker engine, if the family wishes to go out in the evening he is in shape to go with them.

Long Locomotive Runs on the Boston & Maine

THE BOSTON & MAINE and the New York, New Haven & Hartford are now running locomotives through between New Haven, Conn., and Portland, Me., 271 miles; one passenger train and one freight train each way daily. The route is by way of New London, Putnam, Worcester, Ayer and Lowell. Preparations are being made for a similar arrangement between New Haven, Conn., and White River Junction, Vt., several trains each day; and also for freight trains between New Haven and Boston by way of Worcester and Ayer.

Wage Statistics Compiled for 1930

THE AVERAGE NUMBER of railway employees in the service of Class I railroads for the year 1930 was 1,510,688, as compared with 1,686,769 in 1929 and 1,680,187 in 1928, according to a consolidation issued by the Interstate Commerce Commission of the monthly summaries of wage statistics issued during the year. For the year, the average, based on the twelve monthly counts as of the middle of each month, was a decrease of 10.44 per cent as compared with 1929. The total compensation for the year was $2,590,274,843, a decrease of 11.92 per cent. The average straight-time hourly earnings for all employees reported on the hourly basis increased from 62.5 to 63.5 cents, and the average straight-time daily earnings of all employees reported on the daily basis increased from $8.42 to $8.55. The number of employees in January, 1930, was 1,561, 035 and in December of last year it was 1,356,558.

Supply Trade Notes

R. C. VILAS, chairman of the board of the Pyle-National Company, Chicago, has resigned on account of poor health.

THE HUTCHINS CAR ROOFING COMPANY has moved its New York office from 342 Madison avenue, to 500 Fifth avenue.

CLARK P. POND has been appointed vice-president engineering and sales, of the Truscon Steel Company, Youngstown, Ohio.

JOHN D. TYSON, formerly assistant metallurgical engineer of the Standard Steel Works Company, Burnham, Pa., has been appointed chief metallurgist.

BRADLEY STOUGHTON, since 1923 professor of metallurgy at Lehigh University, has been appointed consulting metallurgist of Standard Steel Works Company, Burnham, Pa.

GEORGE A. LONG, manager of the Industrial Brownhoist Corporation, Cleveland, Ohio, has been transferred to Bay City, Mich., to succeed J. Stanley See resigned.

J. H. BAILY, secretary of the Edgewater Steel Company, Pittsburgh, Pa., has been elected a vice-president and D. W. McGeorge, assistant secretary, has been elected secretary.

THE GEOMETRIC TOOL COMPANY, New Haven, Conn., has appointed J. C. Ross & Co., 2207 First avenue, South, Seattle, Wash., as its selling agents in the States of Washington and Oregon.

THE STANDARD COUPLER COMPANY, New York, has moved its Chicago office from 120 South La Salle street, to the Strous building, 310 South Michigan avenue. B. W. Brooks is resident representative of the company at Chicago.

THE ARMCO RAILROAD SALES COMPANY, which handles the sales of wrought steel wheels, locomotive packet sheets, car-siding sheets and plates, and galvanized black and blue annealed sheets to the railroads for the American Rolling Mill Company, Middletown, Ohio, has opened a district sales office at 1120 Midland Bank building, Cleveland, Ohio. W. N. Crout is the district sales representative.

HENRY B. NICKERSON, vice-president of the Consolidated Ashcroft Hancock Company, has been elected vice-president in charge of sales of the Ashton

Henry B. Nickerson

Valve Company, Boston, Mass. Mr. Nickerson will have his headquarters at the main office. Previous to his service with the Consolidated Ashcroft Hancock Company, Mr. Nickerson had served with the American Schaeffer & Budenberg Corporation and the American Steam Gage & Valve Manufacturing Company.

THE HYATT ROLLER BEARING COMPANY, Harrison, N. J., has moved the office of its western sales division from 111 West Washington street to the Carbide & Carbon building, 230 North Michigan avenue, Chicago.

J. S. LEMLEY and Frank J. Kearney, vice-presidents of the T-Z Railway Equipment Company, Chicago, have been elected vice-presidents of the Morris B. Brewster Company, Chicago. William Wright, mechanical engineer of the T-Z Railway Equipment Company, has been appointed mechanical engineer of the Morris B. Brewster Company.

E. M. VEHMEYER, sales manager in the Detroit, Mich., plant of Joseph T. Ryerson & Son, Inc., has been appointed manager of the plant. Mr. Vehmeyer has been associated with Joseph T. Ryerson & Son, Inc., for over 22 years, most of his time having been spent in the sales and service departments. For the last two years he has held the position of sales manager in the Detroit plant. W. H. Basse, formerly Detroit plant manager, has been transferred to Chicago where he will engage in special sales work.

(Continued on next left-hand page)

Domestic Orders Reported During March, 1931

Locomotives

Name of Company	Number ordered	Type	Builder
Chicago, Milwaukee, St. Paul & Pacific	8	4-6-4	Baldwin Loco. Works
Total for month	8		

Freight Cars

Name of Company	Number ordered	Type	Builder
Bessemer & Lake Erie	350	Hopper	American Car & Fdy. Co.
	300	Hopper	Pressed Steel Car Co.
	300	Hopper	Standard Steel Car Corp.
	100	Hopper	Greenville Steel Car Co.
Union Pacific	1	Plow	Rodger Ballast Car Co.
Fisher Lumber Corp.	20	Logging	American Car & Fdy. Co.
Union Railroad	10	Air dump	Differential Steel Car Co.
	10	Air dump	Magor Car Corp.
East Jersey Railroad & Terminal	17	Tank	American Car & Fdy. Co.
The Hauser Construction Company	8	Air dump	Magor Car Corporation
Merchants Despatch, Inc.	1000	Refrigerator	Merchants Despatch Trans. Co.
L.C.L. Corporation	50	Container	American Car & Fdy. Co.
Total for month	2166		

THE BETHLEHEM STEEL COMPANY, Bethlehem, Pa., has become a licensee of the Nitralloy Corporation, New York, in the field of alloy steels. In the United States there are five other licenses for Nitralloy steel and, in addition, licenses have been granted to six companies manufacturing steel castings.

Obituary

ALBERT M. HICKS, who was connected with the Hicks Locomotive & Car Company, Chicago, until his retirement in 1909, died in Taylorville, Ill., on February 5 from pneumonia.

STANLEY HALE BULLARD, vice-president of the Bullard Company, Bridgeport, Conn., died on March 22 at his home in Fairfield, Conn, at the age of 53. Mr. Bullard, who had suffered with heart trouble for about a year and was obliged to give up his business and other activities, had apparently recovered, and for the past several weeks had been assuming more actively his former place in the Bullard organization. Mr. Bullard was the son of Edward Payson Bullard, the founder of the Bullard Company, and was born on July 4, 1877, at Hoboken, N. J. He had been prominent in the machine tool industry as a manufacturer for the past 35 years, together with his four brothers, who, comprising the executive staff of the Bullard Company, followed the business established by their father 51 years ago. After graduating in 1890 from the New York Military Academy, he entered the employ of his father as a machinist apprentice and, after completing this period of service, was engaged in sales work. He first became manager of the New York office of the company and later manager of the eastern sales district. In 1905 he was appointed general sales manager and in 1915 elected a vice-president, becoming also general works manager. Mr. Bullard was an enthusiastic and outstanding factor in the progress of the metal working industry and, besides his many local civic activities, gave a great deal of his time to civic affairs of national importance to business in general. At various times he held offices with many technical and other organizations.

Stanley Hale Bullard

Personal Mention

General

G. R. GALLOWAY, master mechanic of the Baltimore & Ohio at Baltimore, Md., has been appointed acting superintendent motive power, Western lines, with headquarters at Cincinnati, Ohio.

A. K. GALLAWAY, superintendent of motive power of the Western lines of the Baltimore & Ohio, has been appointed acting superintendent motive power, Eastern lines, succeeding C. A. Gill who has been granted a leave of absence to assist in the reorganization of Russian railroads.

JAMES E. DAVENPORT, assistant to assistant general manager of the New York terminal district of the New York Central, has been appointed assistant to vice-president. Mr. Davenport was born at Charlestown, W. Va., on October 8, 1887, and was educated at Georgia School of Technology, receiving the degrees of B. S. in M. E. in 1908, and B. S. in E. E. in 1909. He entered railroad service in 1909 as special apprentice at the West Albany shops of the New York Central, remaining in that position until 1912, when he was appointed enginehouse foreman at N. White Plains, N. Y. In 1914 Mr. Davenport was appointed dynamometer car engineer; in 1917 trainmaster of the Harlem division, and in 1918 was transferred to a similar position on the Mohawk division. He served as engineer dynamometer tests from 1920 to 1923, and in the latter year was appointed superintendent fuel in locomotive performance. In 1926 he was advanced to the position of superintendent of the Adirondack division; from 1927 to 1930 served as superintendent of the River division, and in 1930 was appointed assistant to assistant general manager.

James E. Davenport

Master Mechanics and Road Foremen

W. B. PORTERFIELD, superintendent of the Glenwood shops of the Baltimore & Ohio at Pittsburgh, Pa., has been appointed acting district master mechanic of the West Virginia district, with headquarters at Wheeling, W. Va.

THE TITLE of R. Skidmore, shop superintendent of the Kansas City Southern at Pittsburg, Kan., has been changed to master mechanic.

F. M. SCHLICER, assistant master mechanic of the Decatur shops of the Louisville & Nashville at Albany, Ala., has retired under the pension rules of the company.

J. M. PIERCE, master mechanic of the Kansas City Southern at Pittsburg, Kan., has been appointed to fill the newly created position of general master mechanic at Pittsburg. Mr. Pierce, who will have jurisdiction over locomotive repairs on the entire line, was born in Paris, Tenn., on February 7, 1885. He entered the employ of the Kansas City Southern on November 16, 1908, as a machinist at Shreveport, La. On August 1, 1914, he was promoted to the position of enginehouse foreman; on July 4, 1918, became general foreman at Shreveport, and on October 25, 1922, appointed master mechanic at Heavener, Okla. He returned to Shreveport as master mechanic on November 1, 1923, and was transferred to Pittsburg on May 1, 1929.

J. M. Pierce

THE HEADQUARTERS of D. E. McLean, master mechanic of the Dauphin division of the Canadian National, have been removed from Kamsack, Sask., to Dauphin, Man.

A. E. MCMILLAN, master mechanic of the Baltimore & Ohio at Wheeling, W. Va., has been appointed acting district master mechanic of the Maryland district, with headquarters at Baltimore, Md.

T. D. SAAR, chief locomotive inspector of the Kansas City Southern, has been promoted to the position of division master mechanic, with headquarters at Pittsburg, Kan. Mr. Saar was born at

(Continued on next left-hand page)

Railway Mechanical Engineer

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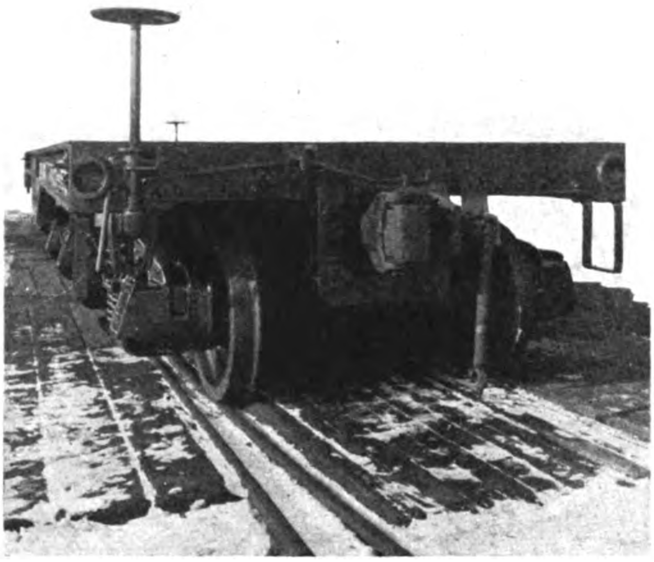


Front view of C. & N.W. 200-ton flat cars showing coupler - release mechanism and hand-brake application

Chicago & North Western 200 - Ton Flat Cars

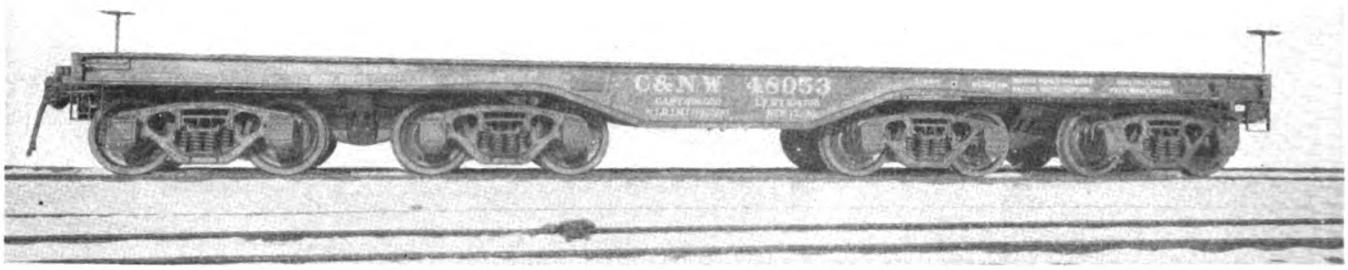
THE Chicago & North Western has recently placed in service two 200-ton special flat cars which will be used largely in handling heavy machinery out of the Milwaukee, Wis., territory. These cars, built at the Chicago shops of the railroad, weigh a total of 104,700 lb. and embody cast-steel construction practically throughout. The cast-steel frame weighs 42,060 lb. The combination of two trucks and span bolster, constituting the truck equipment at each end of the car, has a combined weight of 25,395 lb. The cars are equipped with a 3/8-in. steel-plate floor which is slotted crosswise with numerous holes to facilitate the fastening of lading.

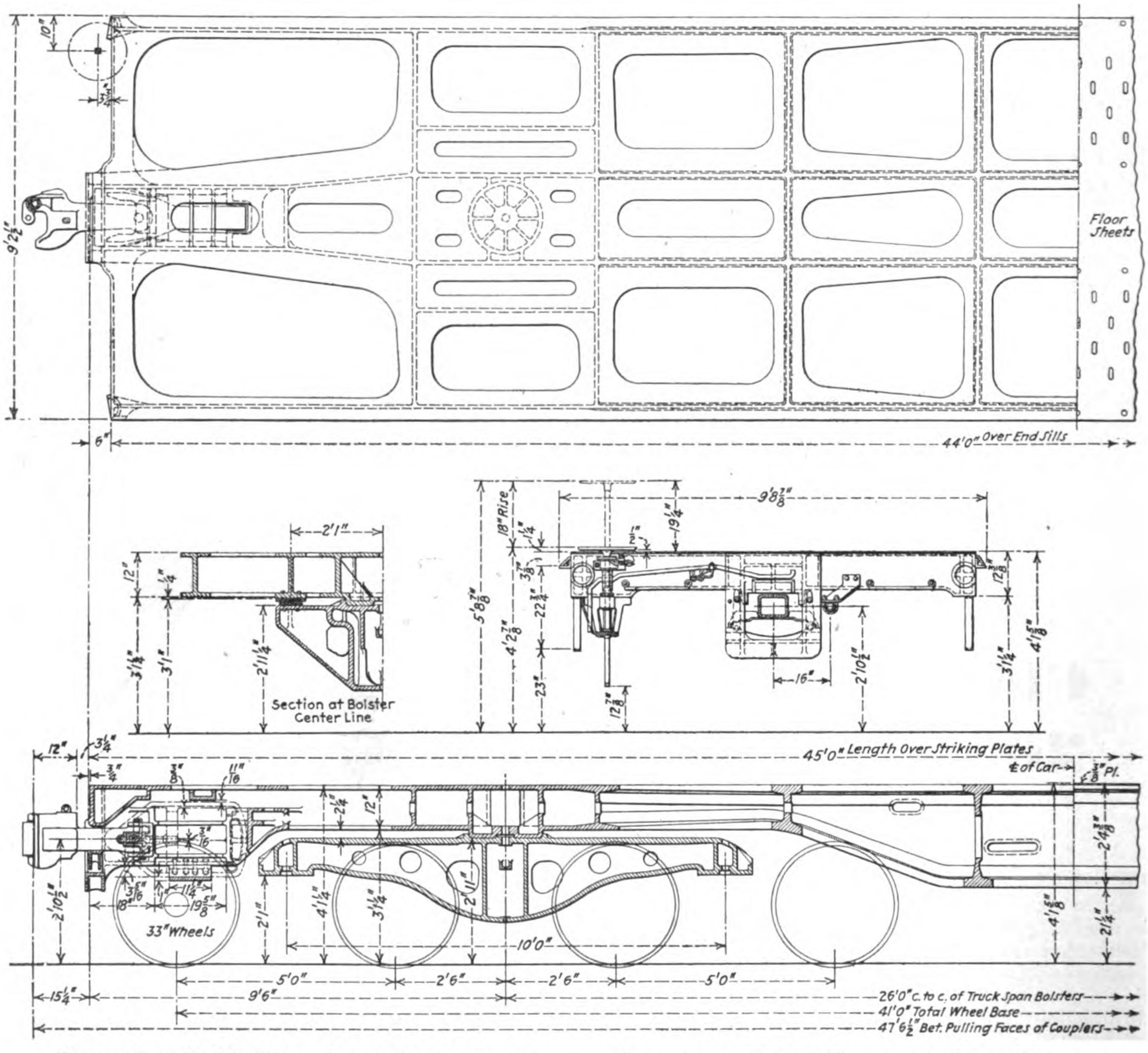
The advantages gained from the use of cast steel construction in these cars are anticipated to include, first, reduced maintenance on account of the one-piece body and, second, longer life on account of less loss of strength from corrosion.

Design Details

The trucks are of the Dalman type for 6½-in. by 12-in. journals. The journal boxes are cast integral with the side frames. Each truck has a wheel base of 5 ft. and the wheel base of the combined unit of two trucks and span bolster at each end of the car is 15 ft. The center plates of the cast-steel frame are spaced 26 ft. apart and set back 9 ft. 6 in. from the striking plate at each end of the car.

The draft gear application is somewhat unusual in that two gears are provided at each end of the car, one placed above the other in a cast-steel yoke. The hand-brake application is such that the brake shaft at each





Above: C. & N. W. 200-ton flat car for handling heavy machinery loads—Below: Plan and sections of the car

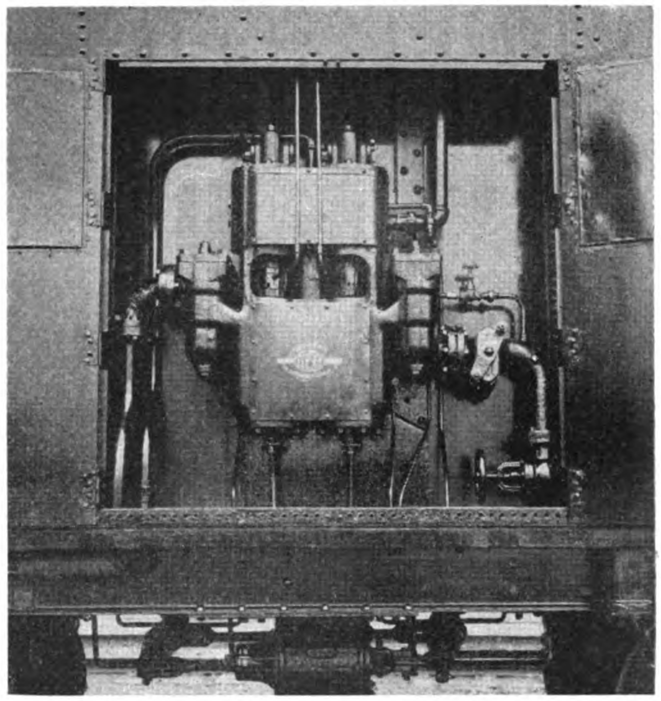
end of the car operates the brakes on the two trucks at that end of the car, only. One end of the car showing the hand brake installation is shown in one of the illustrations.

The accompanying table gives a complete list of specialties used in the construction of the cars.

Specialties Used on C. & N. W. 200-Ton Special Flat Cars

Product	Manufacturer
Air brake—Two complete sets, schedule KD-1012	Westinghouse Air Brake Co.
Body center plate—Cast steel, intergral with underframe	General Steel Castings Corp., Commonwealth division
Brake beam—A. R. A. No. 3	American Steel Foundries

Brake beam hanger—Loop-type, drop forged	Schaefer Equipment Company
Brake-beam suspension—Four-point support and No. 54 safety arms	Davis Brake Beam Company
Coupler—Type D, top-operating with shank arranged for Symington swivel butt	American Steel Foundries
Coupler centering device	Union Metal Products Company
Coupler release rigging	National Malleable & Steel Castings Co.
Draft gear—No. 151—Two at each end of car	Waugh Equipment Company
Dust guards	Dust Guards, Inc.
Hand brake, high power drop brake shaft	Union Railway Equipment Company
Journal box—A.R.A. 6½-in. by 12-in. cast steel, cast integral with truck side frame	....
Journal-box lid—Non-hood, with pin retainer and the Mohun spring	Railway Steel Spring Company
Paint—Code letter "A"—No. 1 mineral paint	Chicago & North Western
Pipe—Standard full weight, genuine wrought iron	....
Side bearing—Friction type, having ½-in. wear plates	....
Springs—A.R.A. Class H cluster of double coil springs with two double coil springs of the A.R.A. Class H spring	....
Truck bolster—Cast steel, Dalman type	Buckeye Steel Castings Company
Truck span bolster—Cast steel	Buckeye Steel Castings Company
Truck side frame—Cast steel, Dalman type	Buckeye Steel Castings Company
Truck bottom connection—Drop forged, off-set connection	Schaefer Equipment Company
Underframe—Cast steel, fish belly type	General Steel Castings Corp., Commonwealth division
Wheels—33-in. multiple-wear wrought steel with 1923 tread	Illinois Steel Company
Coupler yoke—Cast steel	
Pattern	Chicago & North Western
Yokes	American Steel Foundries



The Elesco boiler feed pump is mounted in a compartment on the left side of the tender midway between the two trucks

Boiler Feed Pump Mounted on the Tender

*By H. B. Bowen**

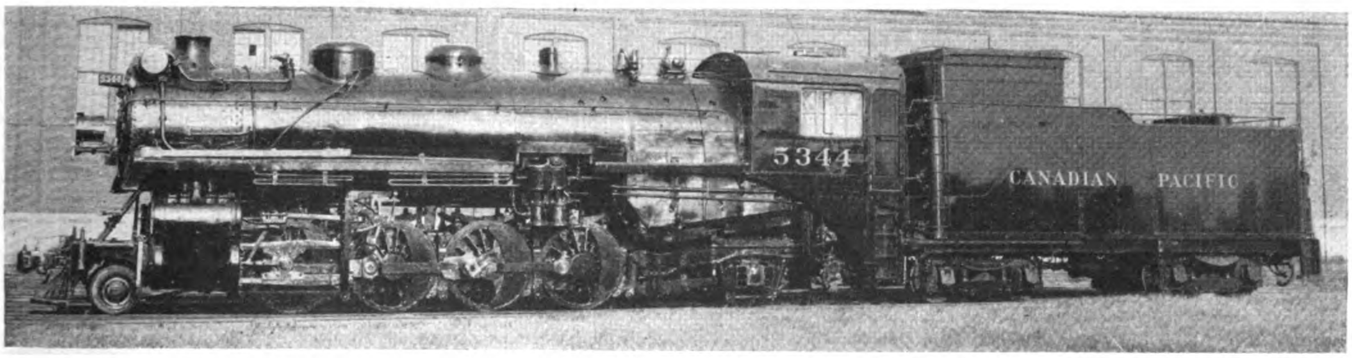
An interesting and satisfactory application of an Elesco CF-1 boiler feed pump, located in a compartment provided in the tender tank, was recently made on the Canadian Pacific Mikado type locomotive 5344. The pump compartment is 72 in. long and 18 in. deep and is located on the left side of the tank in a position midway between the two tender trucks. The pump is mounted on suitable brackets which are securely fastened to the tender underframe in such a manner that the weight of the pump is transferred directly to the underframe.

Flexible metallic connections are provided between the engine and tender for conveying live steam to the pump and the pump discharge to the feedwater heater. The pump exhaust is carried to an Elesco standard oil skimmer located within the tender tank. The pump suction is taken from near the bottom of the tank through the combined strainer and elbow connections to a suitable shut-off valve.

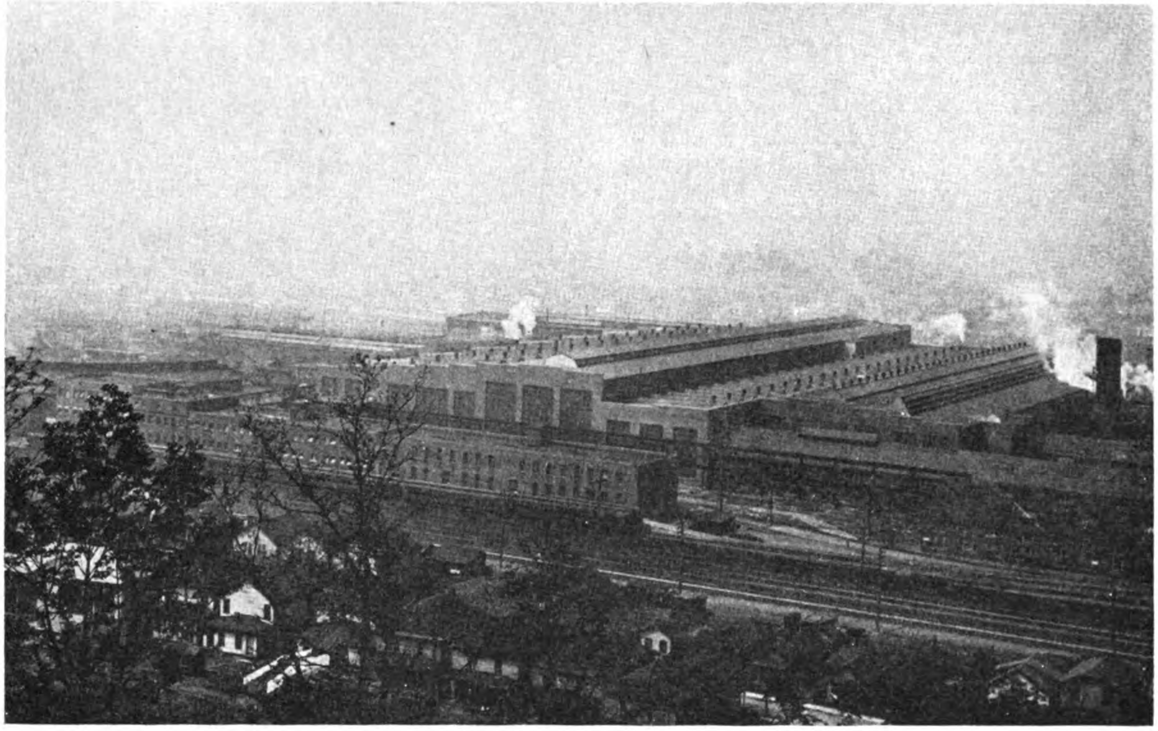
* Chief of motive power and rolling stock, Canadian Pacific.

The tender tank location for a boiler feed pump seems to offer a number of advantages over the conventional location on the side of the boiler. Some of the most important, perhaps, being the exclusion of the pump liner and bracket from the boiler, with its necessary rivets and studs, the decrease in weight on the engine proper and the transfer of the weight of the boiler feed pump to a location where, as a rule, a desirable distribution can be obtained.

In addition to the foregoing, the tender tank location facilitates inspection. Not the least important on a modern locomotive where weight is almost invariably a predominating factor, a tender tank location permits the use of a reciprocating type of pump without encroaching on weight limitations. While from the viewpoint of new locomotive design all of the features above mentioned are very desirable, there are also additional advantages when applying feedwater heater equipment to existing locomotives, in which case the application may be made without the necessity of altering the location of air pumps, running boards, running board brackets, air reservoirs, etc. This interesting boiler feed pump application is made on the locomotive shown below.



The Canadian Pacific locomotive on which the boiler feed pump is located on the tender—The plates covering the compartment can be seen on the tank



The Huntington Shops of The Chesapeake & Ohio

A modern locomotive repair plant designed and equipped for a definite output of 50 class 2 and 3 repairs each full working month

THERE are two facts concerning the new Chesapeake & Ohio locomotive repair shops at Huntington, W. Va., which make them of exceptional interest to mechanical men—they embody a most effective combination of the advantages of both the longitudinal and transverse shop and they were designed in their entirety and in each individual unit for a definite ultimate output capacity of 50 heavy classified repairs a month.

At Huntington, over a period of many years, the mechanical officers of the Chesapeake & Ohio have had the advantage of actual experience with both types of repair shops at a single location. The original shop, built a number of years ago, was a transverse shop, the machine and erecting portions of which were under one roof. With the great increase in the size of power used on the C. & O., a portion of which is of the heavy Mallet type, it became necessary in 1918 to construct a shop to handle these locomotives. A longitudinal type shop, 70 ft. by 400 ft. was built, having three tracks, each with a capacity of four Mallet type locomotives. This shop was served by two 150-ton traveling cranes which were used for handling the engines. A lean-to, 40 ft. in width, was constructed along the south side of this shop for machinery, the length of which was 265 ft. Under the old layout Mikado and larger locomotives were brought in through the Mallet shop, unwheeled and held on the two outside tracks in the Mallet shop because of the limited length of the tracks in the old machine and boiler shop. Smaller locomotives were unwheeled by an overhead engine hoist located in the south end of the transverse shop and moved over a transfer table to the erecting or boiler shop. In 1926 a new boiler shop was built which lies about 150 ft. east of the old machine shop and is served by a transfer table operating in the space between the boiler and machine shop. With the increasing use of heavy power, the old machine and erecting facilities became inadequate, and while the track space in the Mallet shop was of insufficient capacity, the most limiting feature of the old facilities was the fact that the Mallet shop was of insufficient height to permit handling of locomotives back and forth over the tops of others in the shop which made it necessary to keep the center track open to provide an inlet and outlet to the shop as a whole.

In laying out and constructing the new shops, the only units of the old group which were used were the boiler shop, blacksmith shop and the old Mallet shop. Both the Mallet shop and the boiler shop have, however, been enlarged while the old machine shop and the transfer table were entirely removed and replaced by a large modern building having a 25-pit erecting bay, a heavy machine bay, a light machine bay and a fourth bay which is taken up by driving-box, axle and wheel work. All of the units in the new layout adjoin each other without separating walls and may, therefore, be said to be under one roof in-so-far as operation is concerned.

With this rearrangement of facilities practically all of the disadvantages encountered in the old shop have been overcome and the combination of the longitudinal arrangement of the old shop with the transverse of the new erecting shop has made it possible so to schedule the machine and erecting operations on locomotives passing through the shop for repairs that a considerable saving in the time which locomotives need be held out of service for major repairs has been effected.

Arrangement of Facilities

The Mallet shop was enlarged by the addition of a 52-ft lean-to bay on the north side. This bay has a mezzanine floor 16 ft. above the main floor of the shop and a second floor 26 ft. above the main floor, the main floor being occupied by the pipe shop, jacket shop and air pump department; the mezzanine floor by locker and wash rooms, and the second floor by the tin shop and brass room. Electric freight elevators of 6,000-lb. capacity for handling trucks and materials serve the different floors in this bay.

The new main shop structure consists of four principal units. The erecting bay is 95 ft. wide by 608 ft. long, having 25 pits. This bay is served by one 250-ton crane and three 15-ton messenger cranes. A clear height of 55 ft. 8 in. under the roof trusses permits the movement of locomotives, not only one over another on the pits, but over the messenger cranes as well. The pits in the erecting bay are spaced 24 ft. between centers, providing adequate room for working between them. These pits are 85 ft. long by 4 ft. wide and are provided with plank jacking floors along both sides. All of the pit tracks are at least 115 ft. long and extend 25 ft. from the east end of the pits into the wheel bay, providing storage space for repaired wheels directly on the pit tracks. Six of the tracks extend 37 ft. into the heavy machine bay and one other track, near the center of the bay, extends across the entire shop layout through the boiler shop to a flue shop east of the boiler shop and through the machine shop bays to a blacksmith shop building which lies west of the light machine bay.

To the west of the erecting bay are two machine bays, the first, 80 ft. wide being used for heavy machine work and the second, 60 ft. wide, for light machine work. The lengths of these bays are 550 ft. and they abut on the Mallet shop at the north end. The heavy machine bay has a clear height of 50 ft. to the trusses and is served by two 15-ton cranes. The light machine bay has a second floor throughout its entire length 28 ft. above the first floor and a mezzanine floor 25 ft. wide along the west wall, 16 ft. above the first floor. Both of these upper floors are connected to the main floor by stairways and are open on the side facing the main shop. The mezzanine floor over the light machine bay is occupied by wash and locker rooms and the shop supervisory offices, while the second floor is occupied by a chemical laboratory, turret lathe department and manufacturing tool room. Under the chemical laboratory, on the main floor of the light machine bay, is a physical testing laboratory.

Along the east side of the erecting shop is an additional bay 80 ft. wide, 625 ft. long and 38 ft. high, used for wheel, axle, driving-box, superheater and steam-pipe work.

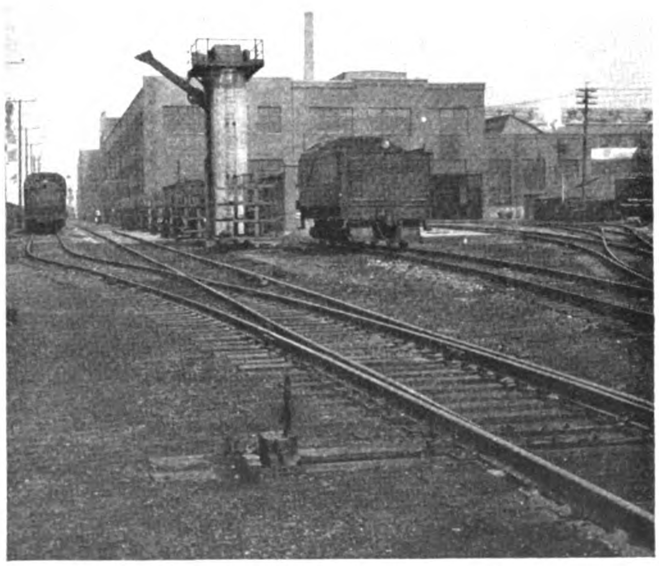
The boiler shop unit which lies alongside the new wheel bay is 140 ft. wide by 530 ft. long and is served by two crane runways—one of 87 ft. span having one 50-ton and one 15-ton crane and the other of 47 ft. span for two 15-ton cranes. The center section of the boiler shop bay is occupied by the tender repair shop and two test pits and repair racks for tender tanks. The north end of the boiler bay is occupied by the tender frame and tender truck shop having five tracks served by a transfer table, two of which are through tracks from the transfer table through the tank shop, the wheel shop, erecting bay and Mallet shop to the west end of the shop. In an emergency locomotives may be taken into or out of the shop from either the east or west side. East of the transfer table serving the tender shop a modern sand-blast plant has been installed.

Seventeen traveling cranes of various types and capacities serve the different shop units. All of these cranes are modern high-speed cranes which will permit the handling of parts with the least possible delay. A large number of smaller capacity cranes, mostly of the jib type, have been installed throughout the shop for the purpose of handling work to and from machines without the necessity of calling on the overhead cranes. The majority of these smaller cranes are equipped with two-ton electric hoists.

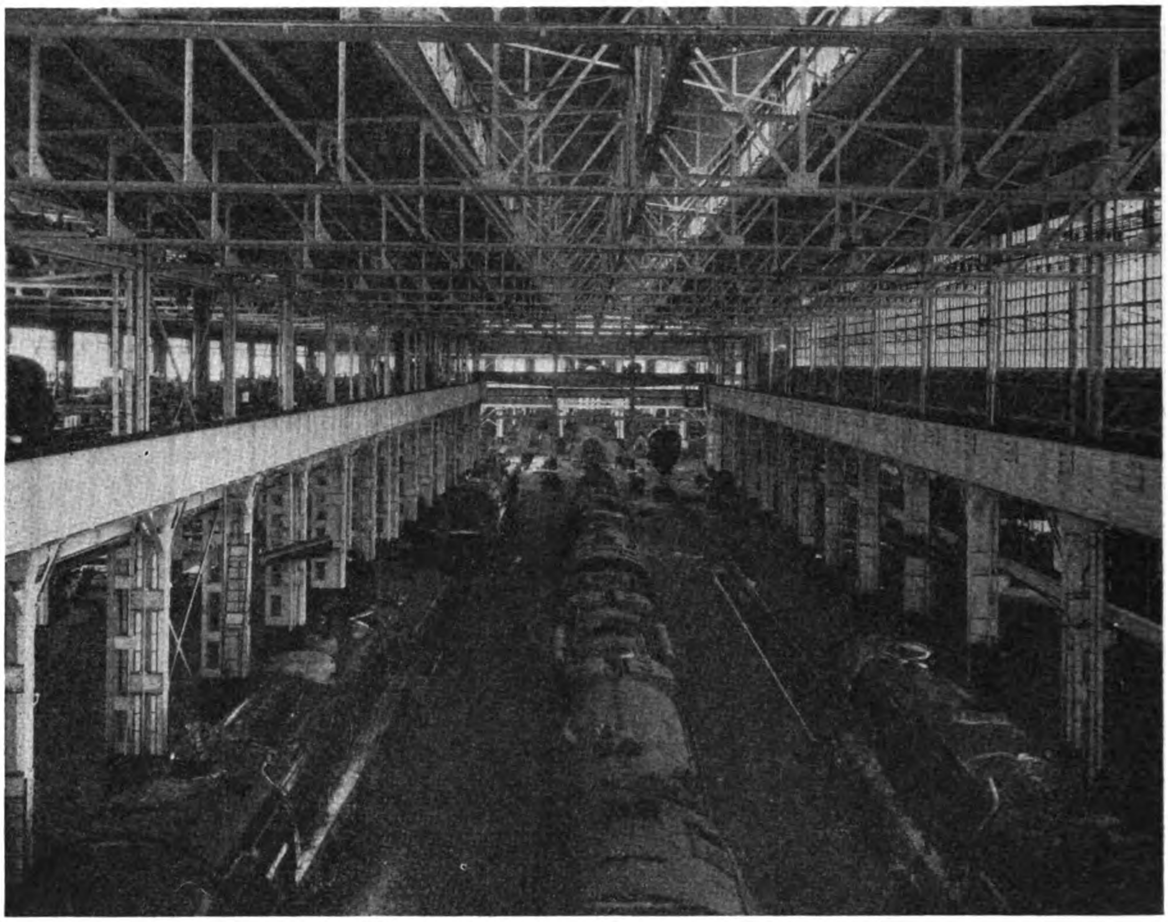
General Scheme of Operation

The Huntington shops were designed with a view to providing the maximum output of locomotives receiving heavy classified repairs with the least possible detention from service and at a minimum expenditure for labor. For this reason the layout of the new shops includes the most modern machine tools and material handling and other shop equipment, and the location of the different groups and units is governed by time- and labor-saving principles. The most modern ideas of plant layout were embodied in the arrangement of the different departments with respect to each other and in the individual units located in each, taking advantage wherever possible of mass-production methods and a straight-line movement of materials and parts over the shortest possible distances.

Complete detailed time studies were first made to determine the number of operations necessary to repair a given number of locomotives per month. This study automatically determined the type, size and capacity of the machine tools required in the plant to produce a balanced shop operation for all of the several depart-



The entrance to the longitudinal shop—Coal transfer conveyor in the foreground, tender storage tracks at the left

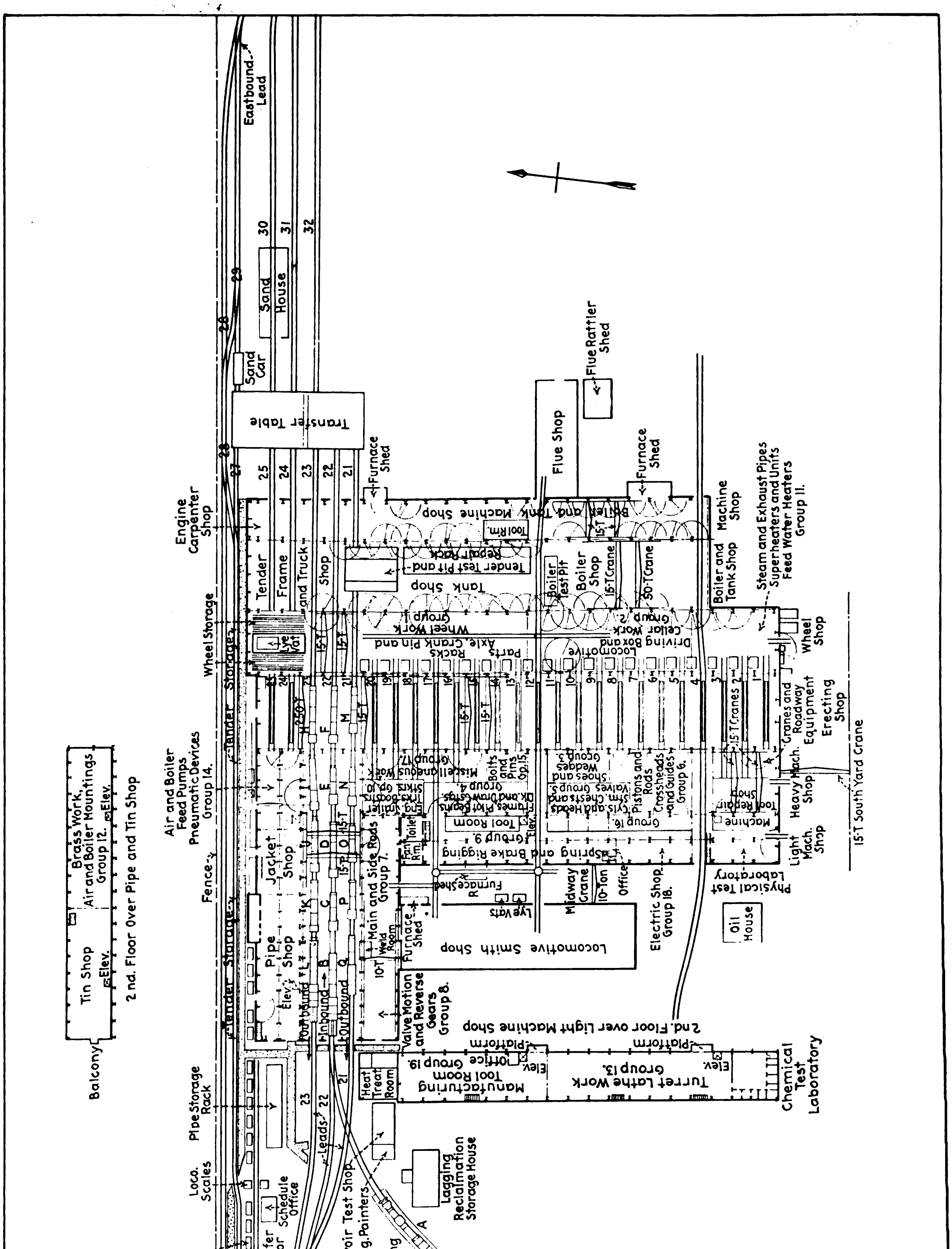


Looking East through the longitudinal part of the shop to the transverse section — Mezzanine and second floors may be seen at the left of the shop

The erecting shop has twenty-five transverse pits

The wheel bay

The boiler and tank shop — Tender tank test racks are shown in the foreground



The Huntington shop is an effective combination of the longitudinal and transverse type of shop

ments. As far as machine tools are concerned, each group or department is equipped with all of the machine tool and shop facilities necessary to perform all of its operations within the allotted schedule time without assistance from other departments or groups. It has been possible in the Huntington shop arrangement to accomplish this result with a surprisingly small duplication of machine and other facilities.

While, of course, under present business conditions it has not been necessary to work the shop at its maximum capacity, the entire plant was designed to turn out 50 Class 2 and 3 locomotive repair jobs each full working month of 25 eight-hour days. The shop has space to accommodate 37 locomotives undergoing repairs at one time. Using all of these spaces continuously, the maximum capacity of the shop would be indicated by 37 times 25, or 925 pit-days per month. The ultimate capacity of 50 locomotives per month was arrived at by dividing the number of pit days by the average number of days required per locomotive for the above mentioned classes of repairs. This was found to be 18.5 working days for the different classes of locomotives on the C. & O., nearly 30 per cent of which are of the Mallet articulated type. On the above program, the shop would be capable of turning out 17 Mallets a month, three of which would receive Class 2 repairs and 14 Class 3 repairs, and in addition, 33 other type locomotives, six receiving Class 2 repairs and 27 receiving Class 3 repairs.

The co-ordination of the work of all departments is accomplished by means of a shop schedule and routing system. In the initial operation of the shop certain maximum schedules were applied which, as time goes on, will be shortened or adjusted as actual operating conditions in the shop indicate to be desirable. At the present time, the average schedules of the days required for locomotives to be in the shop undergoing different classes of repairs are indicated in Table I.

Table I—Average Schedules, Days in Shop

	Days per engine in shop	Total pit days, all engines	Average days per engine on: Inbound progressive positions, Track 22	Heavy repair pits 1-20 and 20-25 inclusive	Outbound progressive positions, Tracks 21 and 23
3 Mallets, Class 2 (New fire box)	25	75	3½	16½	5
14 Mallets, Class 3 (genl. repairs)	20	280	2½	12½	5
17 Mallets	Total	355			
6 other locos. Class 2 (new fire box)	23	138	3½	14½	5
27 other locos. Class 3 (genl. repairs)	16	432	2½	8½	5
33 other locomotives	Total	*570			
50 per month	Average 18.5.	Total 925			

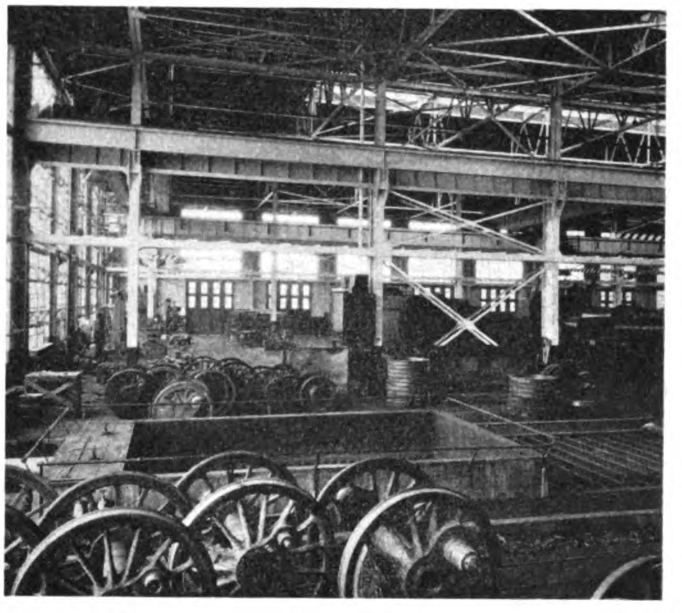
Exclusive of the inbound and outbound progressive positions in the shop there are 22 pits available for heavy-repair work. In accordance with the average number of days required as shown in the above table, there are 22 times 25 pit days, or 550 pit days involved in the heavy repair-work, distributed as follows:

3 Mallets, Class 2 repairs @ 16.5 days	49.5
14 Mallets, Class 3 repairs @ 12.5 days	175.0
6 other locomotives, Class 2 repairs @ 14.5	87.0
27 other locomotives, Class 3 repairs @ 8.5	229.5
Total used	541.0

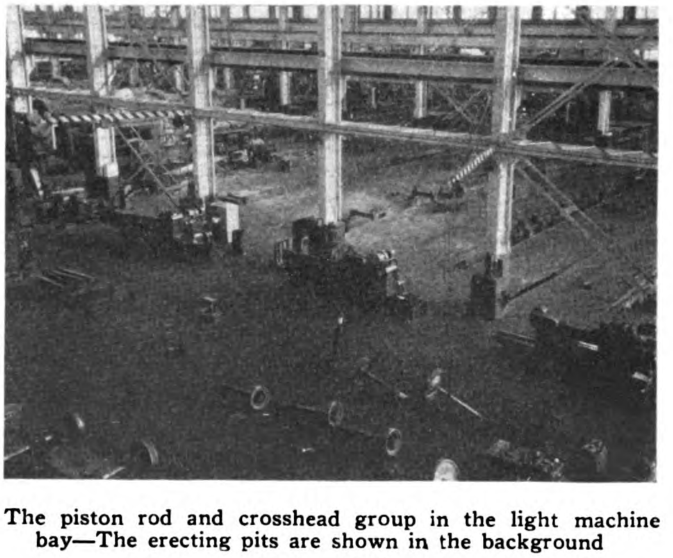
$$\text{Excess pit time per month: } \frac{9 \text{ days} \times 8 \text{ hours}}{22 \text{ pits}} \text{ Equals}$$

3.3 hours per pit per month for cleaning out pits between engines.

The light machine bay from the platform in the turret lathe department



The large lye vats at tracks Nos. 24 and 25 in the erecting bay



The piston rod and crosshead group in the light machine bay—The erecting pits are shown in the background

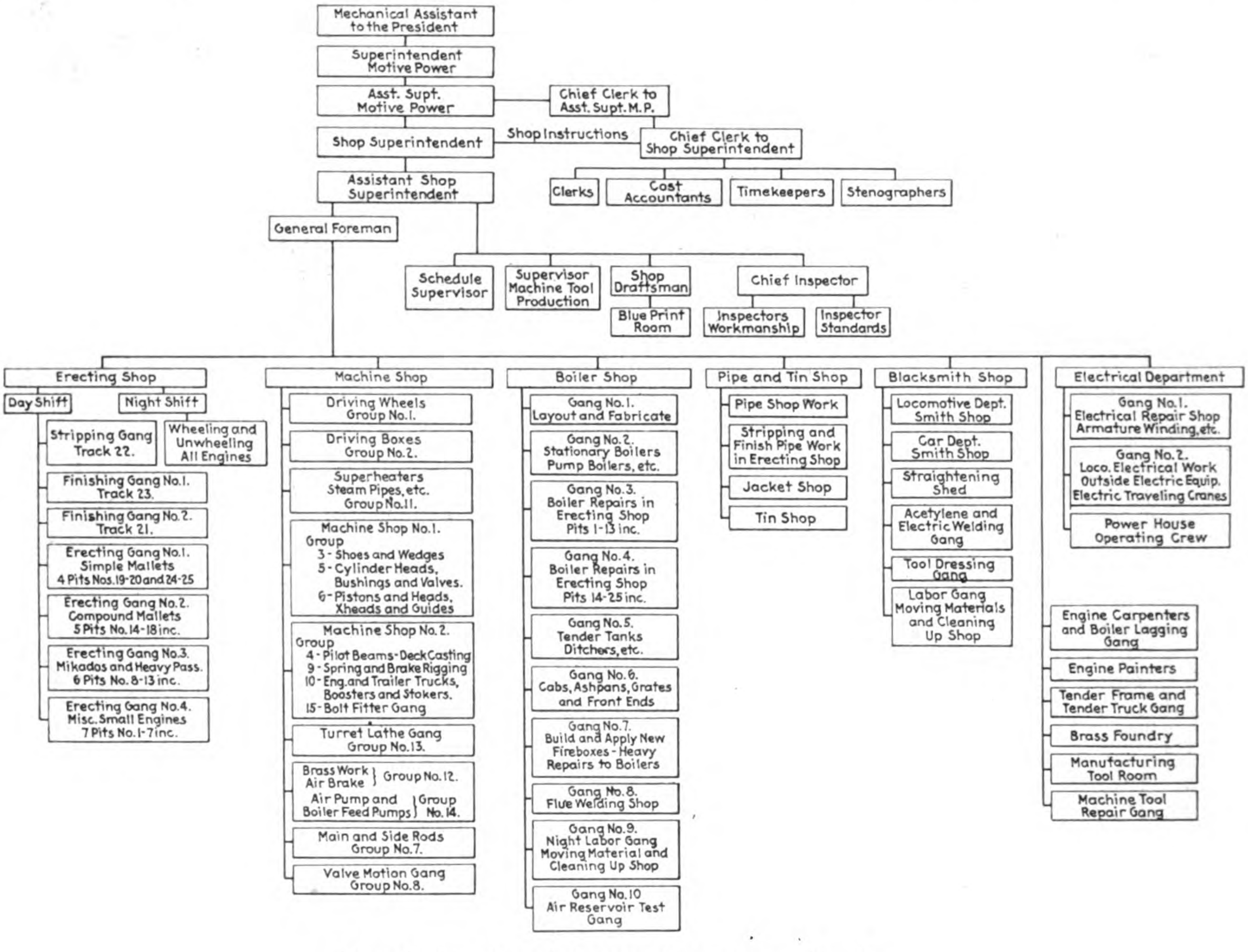
In order to assure a maximum output of 50 classified repairs per month of the class of locomotives described, each major operation on an average set of locomotive material must be completed in $\frac{\text{200 hours}}{\text{50 engines}} = 4$ hours. As will be seen in the subsequent descriptions of machine and erecting operations, each group and unit of the entire shop was designed and equipped to perform each major operation within the time required—namely, four hours.

Shopping of Locomotives

Ninety days before locomotives are scheduled to be shopped for general repairs they are inspected and accompanying the formal request to the superintendent of motive power for authority to shop each locomotive is a statement of any unusual items of material required. These special material requirements are brought to the attention of the general storekeeper periodically so that materials which will be required on locomotive repair work may be procured in ample time before the locomotive is actually taken to the shop for repairs.

As previously mentioned, the Huntington shop is a combination of a longitudinal and transverse type of shop. On the center track of the longitudinal section of the shop certain progressive stripping operations are performed when the locomotive is taken into the shop. The locomotive then passes to the transverse section of the shop where it is unwheeled and assigned to a heavy repair pit where the major repair operations are performed. After these have been completed, the locomotive then returns to either one or the other of the outside tracks in the longitudinal section of the shop and eventually passes out of the shop on the same side where it entered.

In order to present a true picture of the manner in which this shop functions, the path of a locomotive will be traced through the entire repair operation. This description of the shop operation is based on the assumption that the maximum number of locomotives, namely 50 a month, are being repaired. Where conditions such as exist at present require that a lesser number of locomotives be handled, the unit time for the various operations is held as nearly as possible to the schedule as required for maximum output—the variation in output being taken care of by fluctuations in the number of shop-hours worked and the number of machines in operation.



Organization chart of the Huntington locomotive shops

How the Locomotives Are Handled

When the shops are turning out the maximum output of 50 locomotives a month (in 25 working days) two locomotives will be received at the shop each eight hours. The locomotives are despatched to the shops directly from road service and are usually received at the Huntington engine terminal under steam. After having the fires dumped, ash pans cleaned and the boiler

blown down and drained a yard crew spots the engines on the main shop lead, headed east, at position *A*. (This and other positions in the description of the operations indicated by letters are shown on the large drawing of the entire shop layout.) The main shop forces take charge at this point and wash out the front end, ash pan and firebox.

From the main lead the locomotives pass to position *B* on track No. 22 in the longitudinal section of the shop. Here the tender is disconnected and, with a storage-battery electric locomotive used around the shops, is switched back out of the shop on lead track 22 to track 26 where there is located a coal transfer conveyor. Here the coal remaining in the tender is removed and stored for use on outgoing locomotives. An ingenious device consisting of an electric motor with suitable reduction gear box mounted on a standard-gage shop truck is used for operating the stoker conveyor screws on tenders so equipped. In this manner the hand shovelling of coal from tenders into the conveyor pit is eliminated. The tender is then switched through track 28 to the east side of the tank shop and placed on the storage tracks until it is scheduled into the shop for repairs. Inbound tenders pass through the sand-blast house on track 30 and are handled onto the transfer table by means of a transfer-table cable puller. They are then moved into the tank shop in track 22 by means of an electric winch. Outbound tenders are finished and painted on tank shop tracks 23, 24 and 25 and when finished are stored on yard track 27 until called for. When the locomotive to which a tender belongs is completed the tender passes to the coal transfer conveyor and receives sufficient coal to fire up the locomotive.

Inbound Inspection and Stripping

As soon as locomotives are delivered on the lead track at position *A* the main shop inspector makes a thorough examination to ascertain the material that will be needed to make the repairs. He checks his inspection report against the report of the master mechanic sent in when the locomotive was ordered to the shop for repairs and makes a special report of any missing parts that may have been taken from the engine before it was sent to the shop. These, if any, are charged against the operating division from which the engine was sent.

The locomotive is then moved to position *B* on track 22 in the shop, where the stripping gang removes all pipes, gages and boiler mountings. This operation is performed within a four-hour period.

In position *C* to which the locomotive is next moved, the jacket is removed from the boiler if necessary. In this position and main and side rods and motion work are removed. All of the operations in position *C* are completed within a four-hour period, completing the first eight-hour day that the locomotive is in the shop. On the second shop day the locomotive is moved to position *D* where, within a four-hour period, the lagging is removed if necessary and all pipes under the jacket which may have to be removed are taken out. The operations in this position require a four-hour period. In position *E* the next move, the air pumps, power reverse gear, fire door and feedwater-heater pumps are removed and deposited in front of a monorail hoist marked *S* from which they are delivered to a storage rack outside of the shop by means of an electric trolley on the monorail. In this position the cab is loosened up, the pedestal binders are loosened so they may be dropped quickly at the proper time and the stoker loosened up preparatory to its removal. The time allowed for all of the operations in position *E* is four hours, completing the second eight-hour day that the locomotive is in the shop.

From the shop layout diagram, it will be noted that the departments in the shop which are adjacent to the longitudinal stripping and refinishing tracks are those departments which are directly concerned with the repair work on the parts removed and replaced in these several positions. For example, in position *B* the pipe work is removed and the pipe shop is immediately adjacent to that position. In position *C* the rods and motion work are taken off. The rod and motion work repair group is located adjacent to position *C*. In position *E* the air pumps, fire doors, feedwater heaters, etc., are removed. The air pump and pneumatic devices repair group is located here while directly above these stripping tracks, on the second floor, is located the brass room where gages and boiler mountings, etc., are repaired.

After leaving position *E* the locomotive is placed on position *F* on track 22. It is in moving from position *E* to *F* that the locomotive passes from the longitudinal section of the shop to the transverse section and on being placed on position *F* in the main erecting shop the locomotive is lifted by means of the 250-ton crane and, after wheels and binders have been dropped, is moved to its assigned pit for heavy repairs. All of the movements in the longitudinal section of the shop are handled by an electric winch located between tracks 22 and 23 on the east side of the main erecting bay. As soon as the locomotive has been unwheeled in position *F* the wheels are moved eastward on track 22 into the wheel shop bay from which point they are handled by the crane to the proper repair group in that bay.

After the locomotive has been placed upon its assigned pit for heavy repairs, the first eight-hour period is taken up by the removal of all of the parts not previously taken off during preliminary stripping operations and by a minute examination of all cylinder bushings, valve chamber bushings, main frames and boiler to determine the exact extent and nature of repairs required.

Assignment of Pits

In the erecting shop there are four gangs assigned with a view to equalizing, as far as possible, the total number of employees to be supervised as related to the type of locomotive to be handled. Gang No. 1 is assigned to the repair work on the heaviest Mallet locomotives on erecting pits Nos. 19, 20, 24 and 25. Gang No. 2 is assigned to the repair of a lighter series of compound Mallet locomotives on pits Nos. 14 to 18 inclusive. Gang No. 3 looks after the repairs to the Mikado type and heavy passenger locomotives on pits Nos. 8 to 13 inclusive, while gang No. 4 is assigned to repairs on miscellaneous types of smaller locomotives on pits Nos. 1 to 7 inclusive. The remaining pits in the erecting shop are used for progressive operations as follows: Pit No. 22 (inbound) for the unwheeling of all types of locomotives; Pit No. 23 (outbound) is confined to Mallet locomotives first, filling out with Mikado type locomotives to keep this track in continuous operation on wheeling and valve setting with a maximum time allowance of eight hours per locomotive; Pit No. 21 (outbound) handles all locomotives not taken care of on pit 23.

Erecting-Shop Work

The work of stripping locomotives on track No. 22 from positions *B* to *F* and the unwheeling of locomo-

tives preparatory to delivery to the assigned working pit is under the supervision of a stripping foreman. It is his duty to see that all work scheduled for the several positions is performed in those positions in the time allowed. While a locomotive is in the erecting shop the four foremen of the gangs previously mentioned are responsible for the completion on schedule time of the repairs on each locomotive under their supervision. It is the duty of these foremen to see that the pedestal binders are properly fitted, that the spring and brake rigging is erected at the proper time, that the shoes and wedges are laid off properly and that information is extended on special forms provided for the purpose, to the driving-box gang so that the driving boxes may be machined, fitted to the driving wheels and delivered to the erecting shop at the scheduled time. These supervisors in the erecting shop are also responsible for the boring of the cylinder and valve bushings in accordance with standard practice and must see that boilers are made ready for water tests in accordance with the schedule, working with the foremen supervising other crafts which may have to work on each engine in the erecting shop.

Machine-Shop Work

Sufficient machine tool equipment has been provided in the Huntington shop to turn out 50 locomotives a month of the classes mentioned. The machinery operations are divided into groups as follows:

Group 1—Driving wheels, trailer-truck wheels, axles and crank pins
Group 2—Driving boxes
Group 3—Shoes and wedges
Group 4—Frames, pilot beams, deck castings, etc.
Group 5—Cylinder heads, cylinder bushings, steam-chest valves, bushings, and covers
Group 6—Piston and rods, cross heads and guides
Group 7—Main and side rods
Group 8—Valve motion, except power reverse gear and reverse levers
Group 9—Spring and brake rigging
Group 10—Engine trucks, trailer trucks, boosters and stokers
Group 11—Steam and exhaust pipes, superheaters, feedwater heater drums
Group 12—Brass work, cab and boiler mountings, air brakes, except air pumps
Group 13—Turret-lathe work
Group 14—Air pumps, boiler feed pumps and pneumatic devices
Group 15—Bolts and pins
Group 16—Drifting valves, intercepting and by-pass valves, reverse and throttle levers and cylinder-cock rigging
Group 17—Miscellaneous work—fitting binders, braces, etc., with steam hammer and adjusting machine
Group 18—Electric repair shop
Group 19—Manufacturing tool room
Group 20—Machine-tool repair gang

The machine tools and special units of shop equipment in the various groups, together with detailed information concerning their operation will be made the subject of a special article and will, therefore, not be included in this article.

Boiler-Shop Operations

The boiler shop at Huntington was built new in 1926. It has a capacity of nine or ten fireboxes a month and suitable facilities for overhauling 50 locomotive tenders per month. The tenders are switched to the east side of the yard and placed on tracks 29, 30, 31 and 32, track 30 being the inbound approach to the sand-blast house. The tenders are scheduled into the shop in the order in which they are to be turned out. On track 30 they pass through the sand-blast house where the exterior of the tank as well as the coal space is sand blasted. Immediately upon the completion of the sand-blasting operation, the tenders are given a priming coat of paint to prevent the surfaces from rusting. The tenders are then pulled out of the sand-blast house onto the transfer table and delivered in the shop on track 22 where the tender tanks are removed from all rectangular tank type tenders. On Vanderbilt type tenders the tank and frame is lifted off the trucks and placed in position on the repair rack where all tenders are water tested, given the necessary repairs and again water tested before completion and final passing of the work.

While this work is being performed, the trucks are being overhauled and tender frames are given necessary repairs, including new decking where it is required. Entire tanks are assembled on tracks 34 and 35 where they are painted, lettered and varnished. Before completion of the repairs, they are taken out of the shops onto the transfer table and placed on yard track 27 for storage until required. Every effort is made to switch the tenders out of the shop in the order in which they will be required in order to avoid any further or unnecessary handling.

Outbound Progressive Positions

After the completion of the heavy repair work in the main erecting shop, the locomotive is returned to pits 21 and 23 which are held open for the first of the progressive positions in the final finishing of the locomotive. To track 23, or position *H*, are assigned Mallet locomotives and heavy Mikados. In this position, the two units of the Mallet engine are again connected, valves are set and the engine is made ready to move in the progressive line. This operation requires eight hours. In the next progressive position *I* on track 23, the lagging is applied to the boiler. This operation requires another eight hours. The jacket is applied in position *J* and the time required is eight hours. In position *K* all of the pipe work is completed within an eight-hour period. When a locomotive moves to position *L*, the final position in the shop, the tender is taken from the west end of yard storage track 27, sufficient coal for firing up being placed in the tender at the coal-transfer conveyor and the tender switched through lead track 23 to position *L* in the shop where it is coupled onto the locomotive. The locomotive is then filled with hot water from the boiler washing plant and steam from the power house at 150-lb. pressure. Adjacent to this position on tracks 23 and 21 are located Locoblow exhaust hoods and blowers. The locomotive is fired up in the shop and the pressure run up to the working pressure. The safety valves are then set and the locomotive is run out of the shop under its own steam for a trial trip of 30 min. to an hour, upon return from which it is placed again in position *L* for final adjustment for releasing for service at the end of that working day.

When a locomotive is completed in position *L* and released for service, the locomotives in positions *K*, *J*, *I* and *H* are coupled together by suitable connections and the released engine on backing out of the position moves these other locomotives into the next progressive position, leaving the space on erecting shop position *H* open for the delivery of another locomotive to that position for the following day's work.

The purpose of placing all of the large locomotives in the progressive line on track 23 is to put these locomotives next to the pipe and tin shop so as to reduce the amount of handling of materials from these departments to the locomotive.

The smaller classes of locomotives are handled on track 21, working through positions *M*, *N*, *O*, *P*, and *Q* in the same manner as described for positions *H* to *L* inclusive on track 23.

Positive instructions are issued that when locomotives are released from the final positions on tracks 23 and 21 in the main shop, they must be complete and ready for service so as not to require any further adjustments in the enginehouse or train yard.

Layouts of Locomotives On Curves*

By R. F. Hall

The use of unequal scale diagrams in laying out locomotives on curved track to determine if their wheel base arrangements will permit them to pass around curves of a given radius—Part II

THE preceding portion of this study dealt, to a large extent, with methods of laying out locomotives on curved track lines and the errors involved in approximations. In this part of the article, diagrams which appear to be preferable to the Roy diagram are described and their application to actual cases is shown.

The Roy diagram is usually laid out to show both rail lines by concentric circular arcs spaced apart radially a distance equal to the sum of the clearances (either full size or a reduced scale) which are thus assumed as being equal at all wheels. This assumption, at least in the case of American locomotives, is usually invalid. The wheel spacings of the rigid wheel base are laid off on a straight line to the proper horizontal scale. This line is then adjusted with relation to the curved rail lines, the condition of the wheel base passing the curve being met when none of the wheel-position points lies outside the space between the curved lines representing the rails. The relation of these points to the curves is also assumed to show the relation of the wheels to the inner and outer rails. Radial trucks are swung about their radius-bar centers to position them in the curve and, as previously pointed out, this may lead to serious error, due to the difference in the vertical and horizontal scales.

A diagram which avoids the principal errors of the

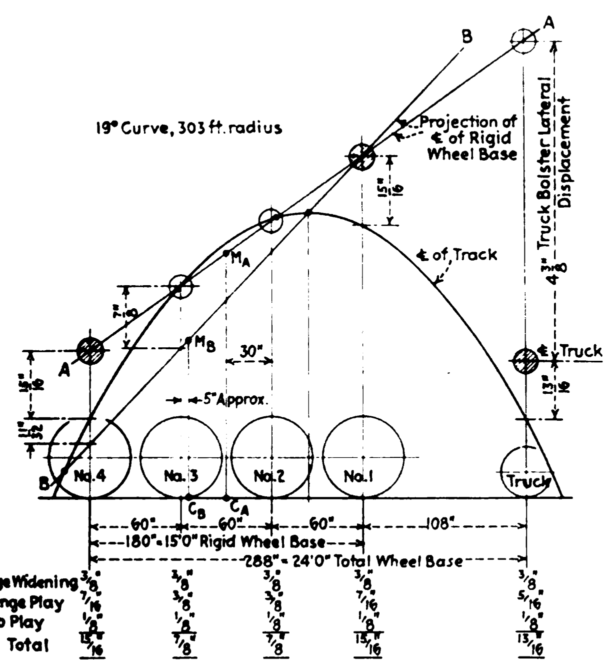


Fig. 4—Layout diagram in which the vertical scale may be full size or any convenient proportion, independently of the horizontal scale

Roy is shown in Fig. 4. This is also of European origin.

It employs a single curved line which represents the center line of the track. This line is laid out in a similar manner to that shown in Fig. 1, (see Part I which was published in the March issue) except that the horizontal scale is reduced in order to conserve space and the vertical scale may be full size or any other convenient proportion, independently of the horizontal scale. The resulting curve approximates an ellipse, the equation to which is:

$$\left(\frac{X}{\frac{R}{h}}\right)^2 + \left(\frac{Y}{\frac{R}{v}}\right)^2 = 1$$

$$Y = \frac{1}{v}\sqrt{R^2 - (hX)^2} \quad \ldots\ldots\ldots\ldots (15)$$

in which X originates at the major (vertical) axis and Y originates at the minor axis. All dimensions are in the same unit.

R = curve radius, in feet

$\frac{1}{h}$ = horizontal scale

$\frac{1}{v}$ = vertical scale.

It should be noted that X and Y are actual *diagram* and not *track* dimensions.

If the curve is laid out from the equation, it will be found more convenient (on account of the remoteness of the minor axis) to lay off the ordinates from the tangent normal to the major axis. These ordinates will then be:

$$O = 12\left(\frac{R}{v} - Y\right) = \frac{D}{v} \quad \ldots\ldots\ldots\ldots (16)$$

where O = ordinate, in inches

D = tangent deflection, in inches

The most practical method of laying out the curve, however, is that first given.

An important advantage of a curve thus obtained is that the error due to the use of an approximate formula

* Part I of this article was published in the March issue of the *Railway Mechanical Engineer.*

for deflections is the same as if all scales were equal and is, therefore, in most cases negligible.

In using the diagram all clearance measurements are made along vertical lines through the wheel positions and normal to the tangent to the curve at its vertical axis of symmetry. This is a most important feature and is equivalent to assuming that parts shifted obliquely between the rails, or which are rotated about a center, do not alter their fore and aft relation to the rails. That the above assumption is substantially correct (within limits) and does not involve undue error will

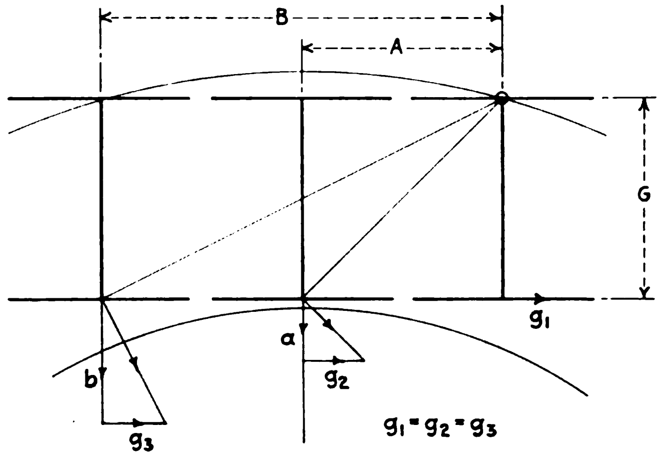


Fig. 5—Showing that a small movement of any wheel about one of the others as a center gives a common angular movement to the whole wheel base

be apparent from a study of Fig. 5 where it is shown that a small movement at any wheel about one of the others as a center gives a common angular movement to the whole wheel base and approximately equal horizontal displacements at each wheel on the side opposite the center of rotation. The effect on the deflection of this difference between the true and apparent wheel positions depends upon the length of the chord, for the vertical direction component of a point on the curve increases with its distance from a given vertical axis. The maximum error in the case shown is evidently at the first and third wheels, being minus at the first and plus at the third. But the longer the wheel base and the sharper the curve the less will be the capacity for angular movement between the rails, which tends to limit the error. At the ends of a 20-ft. chord on a 30-deg. curve (193 ft. radius) the difference in deflection per inch of horizontal movement is 0.05 in., or 1.6 per cent of the deflection. A bolster center displaced laterally 10 in. on a 60-in. radius moves back horizontally only 0.84 in. from its central position.

To position the horizontal center line of the rigid wheel base it is necessary to fix two points on it, which is done in the case of line *A-A*, Fig. 4, by assuming that the first and fourth wheels flange the outer rail. At each of these wheels, then, one-half of the total clearance (15/16 in.) is laid off on their center lines above the curve line, representing a movement toward the outside rail of that amount. Line *A-A* passing through these two points represents the center line of the rigid wheel base and this line, due to the symmetrical movement of the wheel base toward the outer rail, is parallel to its original position with the clearances on both sides equally divided. In general, this line shows the relation of the center lines of the wheel base and the track to each other and when its intersection with a vertical center line through an axle is above the track center line an amount equal to one-half the sum of the clearances at that axle contact of the outer wheel with the rail is shown, while if the intersection lies below the track center line an equal amount, contact of the inner wheel is shown. As commonly used, contact is indicated by shaded circles at the intersections, as in Fig. 4. Line *B-B* shows the conditions when the first outer and the third inner drivers flange their adjacent rails. In this case, the fourth inner driver clears the rail by the amount 7/8 in. — 11/32 in. = 17/32 in. Lines *A-A* and *B-B* thus measure off vertical displacements proportional to the horizontal distances of the different wheels from an assumed center of rotation, the position of this center being first established by direct measurement.

As with the circular arc, the horizontal relation of the wheel base to the vertical axis of symmetry of the curve is unimportant and it will be seen in Fig. 4 that the rigid wheel base has been offset from that axis in order to make the diagram more compact.

Similarly, a line intersecting the curve at two points (or any line parallel to such a line) is normal to the radius of the curve at a point midway between the two intersections. This suggests a means of locating the "friction center" or instantaneous center of the friction forces set up at the wheel treads by the slipping necessary to suit the continuous change of direction of the curve. The geometrical location of this center is at the point on the horizontal center line of the wheel base where a radius line from the center of the curve is normal to that center line. With a given angular position of the wheel base between the rails, its center line is bisected between the two points at which it intersects the curve line, and this mid-point is projected vertically to the horizontal base line as in Fig. 4. The position of the "friction center" (C_A, C_B) with relation to the wheel-base length is thus established. If the wheel-base center line does not intersect the curve in two points, a line parellel to it is drawn which does so intersect and used instead.

The lateral displacement of the leading or trailing

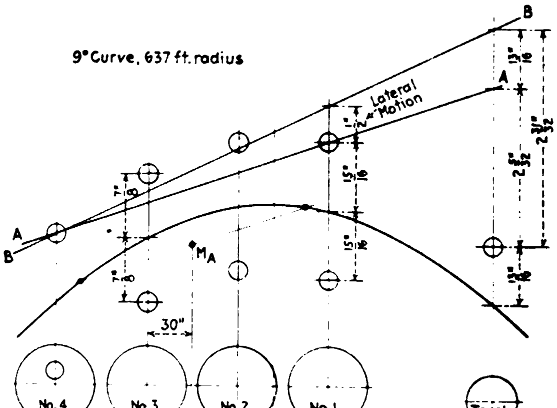


Fig. 6—The author's modification of the diagram shown in Fig. 4

trucks is also readily obtained from the diagram, all clearances from the outer rail at the truck being assumed as taken up and thus deducted from the distance between the engine center line and the curve, as shown.

It will be observed that the diagram just described does not give directly the relations between the wheels and rails, but requires an intermediate step, as in the

case of the fourth inner driver located by line *B-B* of Fig. 4. Where the clearances are equal at all wheels, as in the Roy diagram, this extra step could be avoided by drawing two elliptical curve lines spaced apart vertically a distance equal to the common total clearance. These lines would be duplicates of each other and equivalent to the center line of the curve. This accords with the practice of bending both rails to the radius of the center of the track. The vertical spacing between them would be equal at all points. A straight line positioned between these curves would then show directly the relation of the wheels to the rails, by means of the intersections of this line with vertical lines through the wheel positions.

The clearances at all wheels, however, are seldom equal, and it is thought that the author's modification of the diagram in Fig. 4 will be found more generally useful and convenient. Fig. 6 illustrates the modified diagram. In this diagram a single curve line represents the center line of the track, as before. Above and below this curve, on the vertical center lines of the wheels, the half clearances are laid off, their limits being indicated by small circles or otherwise. The clearances are thus established completely at the outset and the relation of the wheel-base center line to these limit points shows directly the relations of the wheels to the rails on either side. At the trucks it will usually be sufficient to indicate the clearance limit above the curve line only. Fig. 6 also shows the increase in truck lateral displacement due to the use of a lateral-motion device having ½ in. play each side of the center at the first pair of drivers. Although the layout may be used to obtain the truck displacement, it will generally require less time (if this is the only information desired from the diagram) to calculate it by means of the following formula:

$$S = \frac{.0417T\ (W+T)}{R} + L\,\frac{W+T}{W} \quad \ldots.\ (16)$$

where

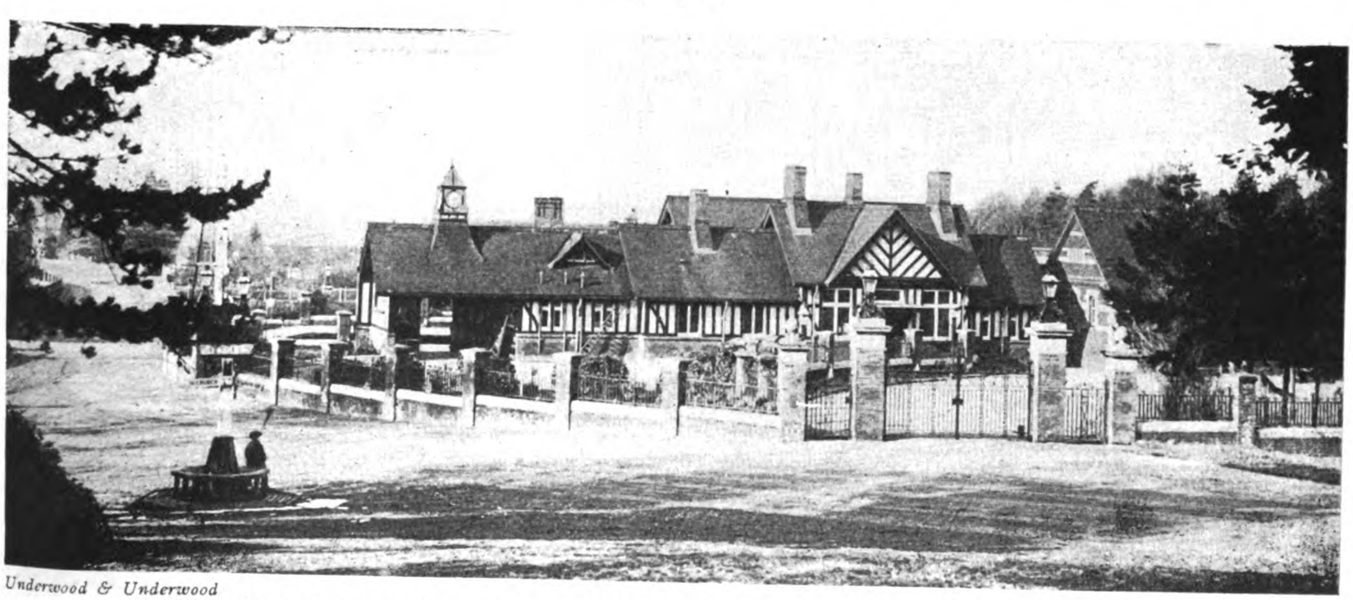
S = truck lateral displacement, in inches
W = rigid wheel base, in inches
T = distance from adjacent driver to truck, in inches
R = radius of maximum curve, in feet
L = lateral motion (each side of center) at adjacent driver, in inches

The first term of the right-hand member is based on the wheel position of line *A-A* in Figs. 4 and 6, while the second term gives the proportionate effect at the truck of the lateral motion at the drivers adjacent to the truck. It can readily be seen that if the rear portion of the rigid wheel base trails toward the inner rail, the truck displacement will thereby be increased, but on the maximum curve which the engine is designed to pass the clearances will be well taken up by the effect of the curvature and the capacity for movement toward the inner rail will be greatly limited. It is customary, therefore, to neglect this effect and also that of the differences in clearances at drivers and truck, and to calculate the displacement, making the actual capacity of the truck for bolster side movement at least equal to the next multiple of ¼ in. greater than the calculated figure.

It may be well to clarify here the statement made above that the relation of the wheel-base center line to the clearance-limit points in Fig. 6 shows directly the relation of the wheels and rails. When the center line passes through a limit point on either side, all the clearances are taken up on that side, including that between the hub and box, but this latter movement is effected by sliding the boxes across the axle and does not move the wheels and axle. Therefore, when all clearances at one wheel are taken up, the flange contact of the opposite wheel clears its rail by the sum of the total gage widening and flange clearance. The *effective* clearance, however, includes also the total hub play, which is then all on one side and the diagram shows the sum of these three clearances as available for center-line movement. This distinction is generally unimportant when the layout is made to determine the possible positions which the engine can assume between the rails, but has considerable influence in flange-pressure calculations.

In conclusion, attention should be called to the desirability of choosing as large a horizontal scale as consistent with a convenient size of layout. It may also be found preferable, in some cases, to make the vertical scale one-half size. The independence of the scales in this form of diagram greatly facilitates their choice.

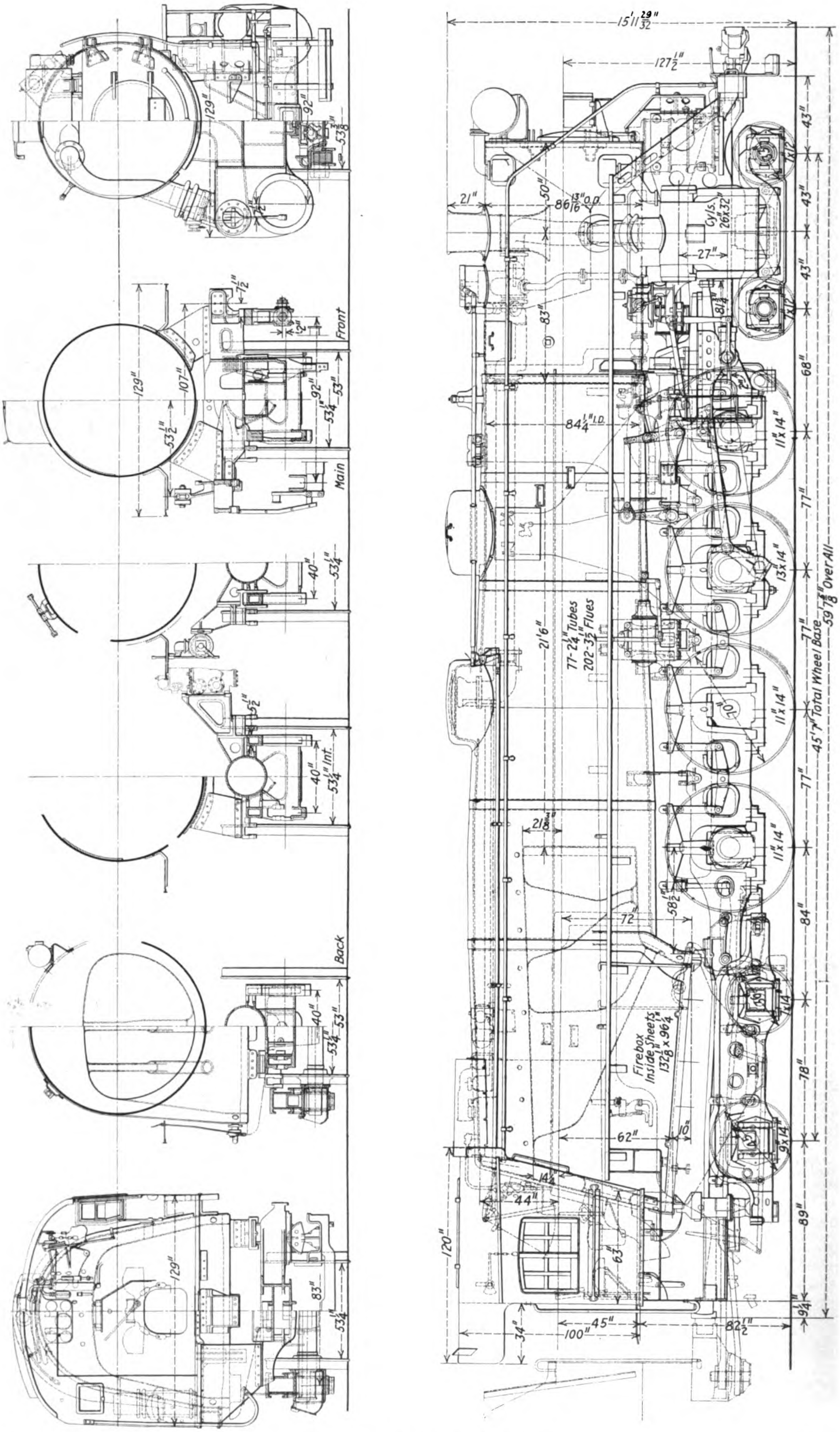
* * *



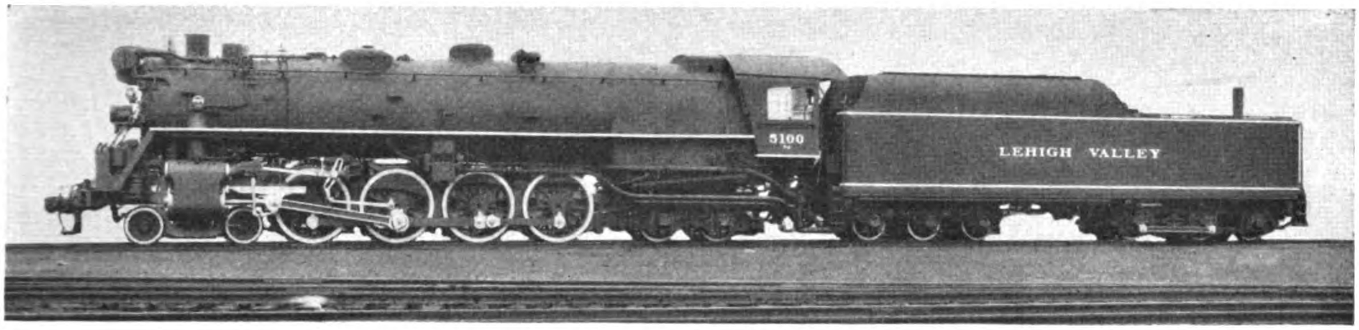
Underwood & Underwood

King George's own railway station at Wolferson on the Royal Estate at Sandringham

The crown and royal coat of arms surmount the station lamps and a suite of rooms is in reserve for the royal family of Great Britain at all times



Elevation and cross sections of the Lehigh Valley 4-8-4 type locomotive No. 5200



Left side of 4-8-4 type locomotive built for the Lehigh Valley by The Baldwin Locomotive Works

Two Freight Locomotives Designed for Fast Service

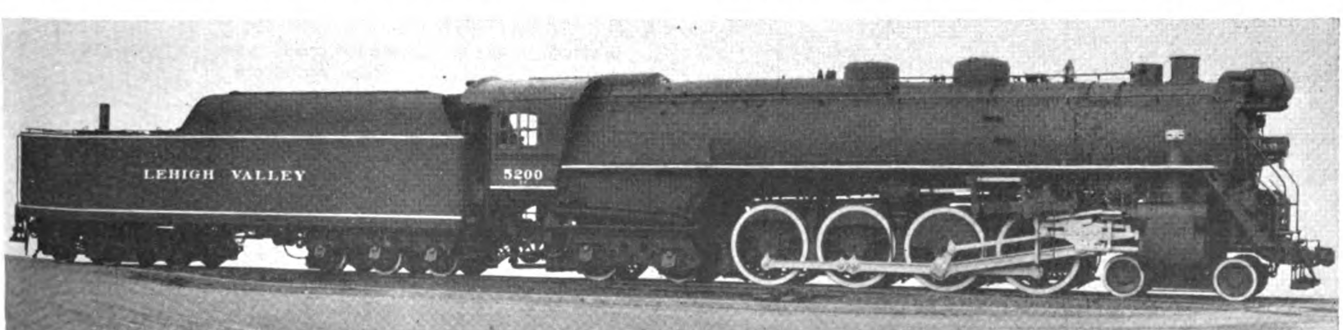
Lehigh Valley buys two 4-8-4 type locomotives for use in fast-freight service between the Niagara frontier and tidewater —Tractive force over 66,000 lb.—To haul 3,000-ton trains with minimum pusher service

TWO 4-8-4 type locomotives were delivered to the Lehigh Valley during the last week in March for operation in fast-freight service between the Canadian frontier and tidewater at Jersey City, N. J. During the week in which the locomotives were delivered, they were exhibited at different towns and cities along the line, and attracted considerable interest. Over 10,000 persons inspected the locomotives while they were on exhibition at Wilkes-Barre, Pa., and there were only a few points where the locomotives were exhibited that the attendance was less than 2,000.

Locomotive No. 5100, road class T-1, was built by the Baldwin Locomotive Works, and locomotive No. 5200, road class T-2, was built by the American Locomotive Company. The former has a rated maximum tractive force of 66,400 lb. and 27-in. by 30-in. cylinders, while the latter exerts a rated maximum tractive force of 66,700 lb. and has 26-in. by 32-in. cylinders. Both locomotives are equipped with Bethlehem auxiliary locomotives which have a rated tractive force estimated at 18,360 lb. This gives a starting tractive force for the No. 5100 of 84,760 lb., and 85,060 lb. for the No. 5200. Both locomotives have 70-in. drivers. The No. 5100 operates at a boiler pressure of 250 lb. and the No. 5200 at a pressure of 255 lb. They are designed to traverse curves of 18 deg.

The locomotives were designed by the builders to meet the special requirements of the railroad for handling merchandise trains in fast-freight service. It was desired to operate the locomotives from Sayre, Pa., to Buffalo, N. Y., from Buffalo to Jersey City, N. J. and back to Sayre, and haul 3,000-ton trains with a minimum of helper service. With the new power, helper service is only required on the Mountain cut-off, near Wilkes-Barre, Pa., where there is a long ascending grade of 1.14 per cent.

It will be noted from the table showing the principle weights and dimensions that the two locomotives are somewhat different with respect to essential features in design to secure approximately the same tractive force within the weight limitations. On the other hand, the general appearance and construction of the two locomotives are essentially the same. Both have welded tenders and cabs. The crown and side sheets of the firebox are in three pieces, with the throat, flue sheet, door sheet and combustion chamber completely welded. The boilers, which are of nickel steel, have Type E superheaters and Elesco feedwater heaters with C. F.

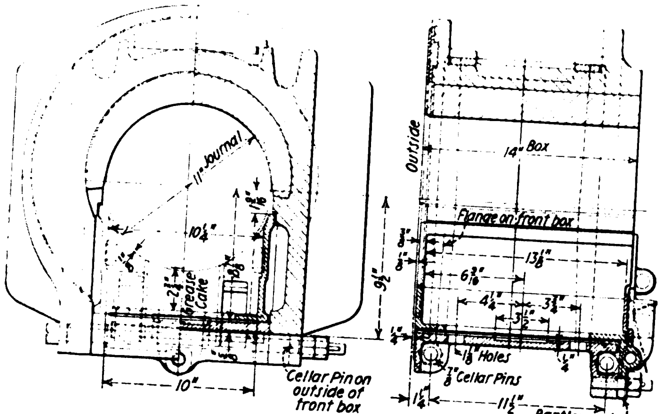


Lehigh Valley 4-8-4 type locomotive built by the American Locomotive Company

pumps. Other special equipment includes Standard type BK stokers, Ragonnet Type E power reverse gears and Commonwealth one-piece bed castings in which are included the cylinders and air reservoirs. Commonwealth front and rear engine trucks are used, the front truck being equipped with SKF roller bearings.

Principal Dimensions, Weights and Proportions of The Lehigh Valley 4-8-4 Type Locomotives

Railroad	Lehigh Valley	
Builders	Baldwin Locomotive Works	American Locomotive Company
Type of locomotive	4-8-4	4-8-4
Road number	5100	5200
Road class	T-1	T-2
Service	Fast freight	
Cylinders, diam. and stroke	27 in. by 30 in.	26 in. by 32 in.
Valve gear, type	Walschaert	Baker



Driving box arrangement on locomotive No. 5200—Grease cakes are renewed through the spring lid on the inside end

Valves, piston type, size	12 in.	12 in.
Maximum travel	7½ in.	8⅝ in.
Outside lap	1⅜ in.	1⅝ in.
Exhaust clearance	⅛ in.	L. and L.
Lead in full gear	¼ in.	¼ in.
Weights in working order:		
On drivers	270,000 lb.	268,000 lb.
On front truck	55,000 lb.	65,200 lb.
On trailing truck	83,000 lb.	88,800 lb.
Total engine	408,000 lb.	422,000 lb.
Total tender	366,200 lb.	358,800 lb.
Total engine and tender	774,200 lb.	780,800 lb.
Wheel bases:		
Driving	19 ft. 3 in.	19 ft. 3 in.
Rigid	12 ft. 10 in.	12 ft. 10 in.
Total Engine	45 ft. 1 in.	45 ft. 7 in.
Engine and Tender	94 ft. 10½ in.	95 ft. 5½ in.
Wheels, diameter outside tires:		
Driving	70 in.	70 in.
Front truck	33 in.	33 in.
Trailing truck, front	42 in.	33 in.
Trailing truck, back	42 in.	36 in.
Journals, diameter and length:		45 in.
Driving, main	13 in. by 14 in.	13 in. by 14 in.
Driving, others	11 in. by 14 in.	11 in. by 14 in.
Front, truck	7 in. by 14 in.	7 in. by 12 in.
Trailing truck, front	8 in. by 14 in.	7 in. by 14 in.
Trailing truck, rear	8 in. by 14 in.	9 in. by 14 in.
Boiler:		
Type	Straight top	
Steam pressure	250 lb.	255 lb.
Fuel, kind	Soft coal	
Diameter, front ring, inside	86 in.	84¼ in.
Firebox, length and width	132⅛ in. by 96¼ in.	132⅛ in. by 96¼ in.
Combustion chamber, length	48 in.	52 in.
Tubes, number and diam.	77—2¼ in.	77—2¼ in.
Flues, number and diam.	202—3½ in.	202—3½ in.
Length over tube sheets	21 ft. 6 in.	21 ft. 6 in.
Grate area	88.3 sq. ft.	88.3 sq. ft.
Heating surfaces:		
Firebox and combustion chamber	490 sq. ft.	508 sq. ft.
Tubes and flues	4,932 sq. ft.	4,933 sq. ft.
Total evaporative	5,422 sq. ft.	5,441 sq. ft.
Superheating	2,256 sq. ft.	2,243 sq. ft.
Comb. evap. and superheat	7,678 sq. ft.	7,684 sq. ft.
Tender:		
Style	Rectangular	
Fuel capacity	28 tons	28 tons
Water capacity	18,000 gal.	18,000 gal.
Wheels, diam. outside tires	36 in.	36 in.
Journals, diam. and length, front truck	6½ in. by 12 in.	6½ in. by 12 in.
General data, estimated:		
Rated tractive force	66,400 lb.	66,700 lb.
Tractive force, booster	18,360 lb.	18,360 lb.
Maximum tractive force, starting	84,760 lb.	85,060 lb.
Weight proportions:		
Weight on drivers ÷ tractive force	4.02	4.07
Weight on driver ÷ total weight engine, per cent	66.0	63.7
Total weight engine ÷ comb. heat surface	53.3	55
Boiler proportions:		
Tractive force ÷ comb. heat. surface	8.64	8.68
Tractive force × diam. drivers ÷ comb. heat. surface	605	607
Firebox heat. surface ÷ grate area	5.55	5.77
Firebox heat. surface, per cent of evap. heat. surface	9.04	9.35
Superheat. surface, per cent of evap. heat. surface	41.6	41.6

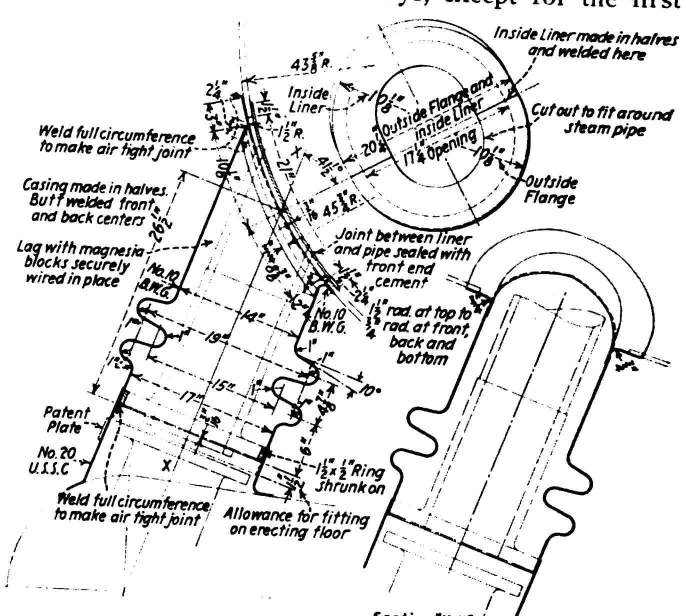
Steam distribution is obtained on the No. 5100 with a Walschaert valve gear and 12-in. valves, and on the No. 5200 with a Baker long-travel gear and valves of the same diameter. The main and side rods are of carbon-vanadium steel. The crossheads are underhung and, in the case of the No. 5100 work in multiple-bearing guides.

Detail Design

The boiler shell and inside firebox of locomotive No. 5100 are constructed of nickel-steel plates. The seams are butt welded. Four Thermic syphons are applied, three in the firebox and one in the combustion chamber. Superheated steam is used for all the auxiliaries, including the auxiliary locomotive, except the whistle and blower.

Lateral-motion boxes are used on the leading drivers. Floating bushings for both main and side rods are used on the main crank pins.

Nickel-steel plates were also used for the boiler shell and inside firebox of locomotive No. 5200, and the same number and arrangement of Thermic syphons. Alco weldless-steel boiler braces were applied. A complete installation was made of the two-piece Flannery type flexible staybolts and radial stays, except for the first



Fetters corrugated steam-pipe casing applied on locomotive No. 5200

row above the firebox ring and those stays directly back of obstructions, such as the grate side frame, fire-door frame, etc., which are hollow rigid bolts. The steam-pipe casing, shown in one of the drawings, is the Fetters corrugated steel-plate type.

The driving boxes on the No. 5200 are equipped with the Alco cast-steel cellar and spreader, arranged for Franklin lubrication. They are designed to facilitate the easy removal and renewal of grease cakes. Access to the cellar is had by means of a lid, which drops down. It is held shut by means of a flat spring. Reverse-gear

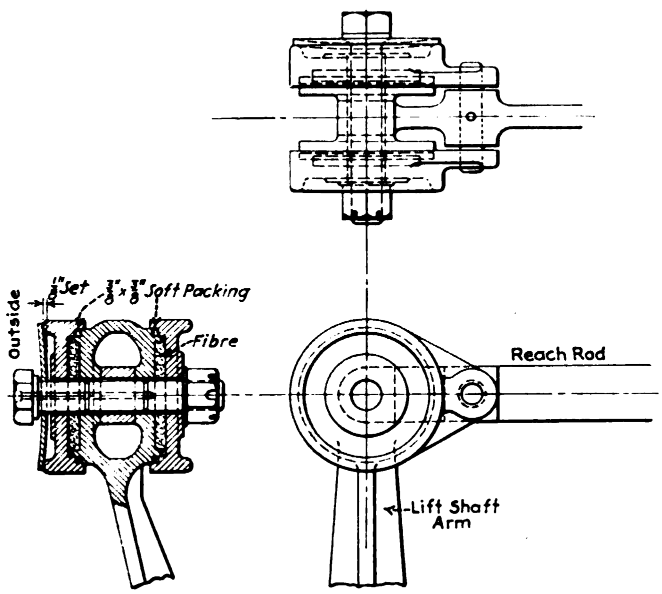
dampeners, shown in one of the drawings, are applied to dampen the shocks ordinarily produced in valve gears and which are transmitted to the reverse gear, tending to make the gear creep. This dampener is incorporated into the reach rod and lift-shaft arm connection, as shown. A compressed spring plate on the outside forces the pin connections against the fibre, which serves as the friction element to produce the dampening effect.

The reverse gear and feedwater pumps are supported by brackets attached to the bed casting, which eliminates studs in the shell of the boiler. The air reservoirs being cast integral with the bed casting also eliminates considerable piping from the right side of the locomotive.

The crossheads on the No. 5200 are of the Laird type fitted with the railroad's standard bronze shoes. The rods are equipped with solid bushings throughout except for the back end of the main and side rod connections which are of the floating type.

Lubrication

Each locomotive is equipped with a Nathan type DV mechanical lubricator having 14 feeds and a capacity for 24 pints of oil. Two feeds run to the cylinder barrels, two feeds to the steam pipes and two to the guides.



Reverse-gear dampener applied on locomotive No. 5200

One feed extends to the air compressor, one to the stoker and one to the feedwater-heater pump. Four feeds run to the driving boxes and one to the atomizer which takes care of the throttle, booster and drifting valves. Dividers for splitting the feeds to the driving boxes are of the railroad's design.

The main crank pins and crosshead wrist pins are grease lubricated and Spee-D lubrication is applied to the back end of the eccentric rod. Oil lubrication is used for the front ends of the main rods.

Alemite grease fittings are applied to the motion work, spring rigging, center plates and chafing castings, gear housing for the stoker, front and back trailing-wheel hubs, end surfaces of the engine-truck bolster, engine- and trailing-truck pedestal surfaces, trailing-truck radius-bar fulcrum, throttle rigging and shoe and wedge surfaces of the driving boxes. The brake rigging has Alemite lubrication as follows: Bell crank at the brake shaft, top brake-hanger pins, brake-head pins, and brake beams at the hangers. The application of grease fittings to the valve gear do not extend beyond the reach-rod connection to the reverse gear.

The tenders have Commonwealth one-piece frames of the water-bottom type. The tanks are built with welded seams. The trucks are of six-wheel design, with the Bethlehem auxiliary locomotive applied to the two pairs

List of Special Parts, Appliances and Equipment on the Lehigh Valley 4-8-4 Type Locomotives Built by the American Locomotive Company and the Baldwin Locomotive Works

<table>
<tr><th></th><th>American</th><th>Baldwin</th></tr>
<tr><td>Railroad</td><td colspan="2">Lehigh Valley</td></tr>
<tr><td>Service</td><td colspan="2">Fast freight</td></tr>
<tr><td>Number built</td><td>One</td><td>One</td></tr>
<tr><td>Boiler and firebox:</td><td></td><td></td></tr>
<tr><td>Blower valve</td><td colspan="2">Lunkenheimer</td></tr>
<tr><td>Blower nozzle</td><td colspan="2">T-Z</td></tr>
<tr><td>Blow-off cocks</td><td colspan="2">Everlasting</td></tr>
<tr><td>Blow-off muffler</td><td colspan="2">Okadee</td></tr>
<tr><td>Boiler and firebox steel</td><td colspan="2">Bethlehem, nickel steel</td></tr>
<tr><td>Feedwater heater and pump</td><td colspan="2">Elesco, type CF pump</td></tr>
<tr><td>Fire brick</td><td colspan="2">General Refractories</td></tr>
<tr><td>Firebox plates</td><td colspan="2">Bethlehem</td></tr>
<tr><td>Firedoor</td><td colspan="2">Franklin</td></tr>
<tr><td>Flexible staybolts</td><td colspan="2">Bethlehem iron, Flannery</td></tr>
<tr><td>Flexible staybolt caps</td><td colspan="2">Two-piece M.K. hollow copper coated</td></tr>
<tr><td>Injectors</td><td colspan="2">Hancock</td></tr>
<tr><td>Lagging</td><td colspan="2">Johns-Manville</td></tr>
<tr><td>Lagging, pipes, cab, etc.</td><td colspan="2">Superinsutape</td></tr>
<tr><td>Safety valves</td><td colspan="2">Consolidated</td></tr>
<tr><td>Smokebox hinges</td><td colspan="2">Okadee</td></tr>
<tr><td>Smokebox netting</td><td colspan="2">Draftac, No. 393</td></tr>
<tr><td>Staybolts, rigid hollow</td><td colspan="2">Ulster</td></tr>
<tr><td>Staybolt sleeves</td><td colspan="2">Flannery</td></tr>
<tr><td>Staybolts, solid</td><td>Bethlehem iron, Flannery</td><td>——</td></tr>
<tr><td>Steam pipe casing</td><td colspan="2">Fetters</td></tr>
<tr><td>Stoker</td><td colspan="2">Standard, type BK</td></tr>
<tr><td>Superheater</td><td colspan="2">Type E</td></tr>
<tr><td>Superheater pipes</td><td>Pittsburgh Steel Products</td><td>National Tube Co.</td></tr>
<tr><td>Syphons</td><td colspan="2">Nicholson Thermic</td></tr>
<tr><td>Throttle</td><td colspan="2">Bradford</td></tr>
<tr><td>Tubes and flues</td><td>Pittsburgh Steel Products</td><td>National Tube Co.</td></tr>
<tr><td>Washout plugs</td><td colspan="2">Housley</td></tr>
<tr><td>Water column</td><td colspan="2">Nathan</td></tr>
<tr><td>Water glass</td><td colspan="2">Nathan (Delco)</td></tr>
<tr><td>Whistle</td><td colspan="2">Hancock</td></tr>
<tr><td>Whistle operator</td><td colspan="2">Viloco</td></tr>
<tr><td>Cylinders and running gear:</td><td></td><td></td></tr>
<tr><td>Auxiliary locomotive</td><td colspan="2">Bethlehem, rear tender truck</td></tr>
<tr><td>Bed frame</td><td colspan="2">General Steel Castings</td></tr>
<tr><td>Crank pins</td><td colspan="2">Hammered O.H. steel</td></tr>
<tr><td>Connecting rods</td><td colspan="2">Carbon-vanadium alloy</td></tr>
<tr><td>Crosshead shoes</td><td>Lehigh Valley, bronze</td><td>Pennsylvania type</td></tr>
<tr><td>Cylinder and valve bushings</td><td colspan="2">Hunt-Spiller</td></tr>
<tr><td>Cylinder cocks</td><td colspan="2">Ardco, air-operated</td></tr>
<tr><td>Cylinder lubricator</td><td colspan="2">Nathan, mechanical type D-V</td></tr>
<tr><td>Cylinder and valve packing</td><td colspan="2">Hunt-Spiller</td></tr>
<tr><td>Drifting valve</td><td colspan="2">Ardco, automatic 7-C-2</td></tr>
<tr><td>Driving axles</td><td colspan="2">Hammered O.H. steel</td></tr>
<tr><td>Driving box, lateral motion</td><td colspan="2">Franklin</td></tr>
<tr><td>Driving box cellars and spreaders</td><td>Alco</td><td>Franklin</td></tr>
<tr><td>Driving box lubricator</td><td>Nathan, mechanical type D-V</td><td>Franklin</td></tr>
<tr><td>Driving tires</td><td colspan="2">Midvale</td></tr>
<tr><td>Engine truck frame</td><td colspan="2">General Steel Castings</td></tr>
<tr><td>Engine truck roller bearings</td><td colspan="2">SKF</td></tr>
<tr><td>Engine truck wheels</td><td>Bethlehem</td><td>Standard Steel</td></tr>
<tr><td>Frame pedestal wedges</td><td colspan="2">Franklin</td></tr>
<tr><td>Grease cups, side rods</td><td colspan="2">Spee-D</td></tr>
<tr><td>Guides</td><td>Alco</td><td>Pennsylvania type</td></tr>
<tr><td>Lubricator fittings, grease</td><td colspan="2">Alemite</td></tr>
<tr><td>Packing, metallic</td><td colspan="2">King type</td></tr>
<tr><td>Piston heads</td><td>Cast steel, Z type.</td><td>R.R. standard</td></tr>
<tr><td>Piston rods</td><td colspan="2">Hammered steel</td></tr>
<tr><td>Piston packing and bull rings</td><td colspan="2">Hunt-Spiller</td></tr>
<tr><td>Reverse gear</td><td colspan="2">Ragonnet, type E</td></tr>
<tr><td>Rod bushings, external</td><td colspan="2">Hunt-Spiller</td></tr>
<tr><td>Springs</td><td colspan="2">Railway Steel Spring</td></tr>
<tr><td>Spring material, engine truck</td><td>Silico-manganese steel</td><td>——</td></tr>
<tr><td>Trailing truck equalizer fulcrum block</td><td>Townsend</td><td>——</td></tr>
<tr><td>Trailing truck frame</td><td colspan="2">General Steel Castings (Delta)</td></tr>
<tr><td>Trailing truck wheels, front</td><td>Carnegie</td><td>Standard</td></tr>
<tr><td>Valve gear</td><td>Baker, long travel</td><td>Walschaert</td></tr>
<tr><td>Valve, aux.-loco</td><td colspan="2">Lunkenheimer</td></tr>
<tr><td>Valves, miscellaneous</td><td colspan="2">Ohio Valve</td></tr>
<tr><td>Cab and miscellaneous:</td><td></td><td></td></tr>
<tr><td>Air brakes</td><td colspan="2">Westinghouse, E.T. No. 6</td></tr>
<tr><td>Air signal</td><td colspan="2">Westinghouse, Schedule L</td></tr>
<tr><td>Bell ringer</td><td colspan="2">Transportation Devices</td></tr>
<tr><td>Brake, foundation</td><td colspan="2">American</td></tr>
<tr><td>Brake shoes, driver</td><td colspan="2">American Brake Shoe & Fdry.</td></tr>
<tr><td>Brake valve, pedestal</td><td colspan="2">Westinghouse</td></tr>
<tr><td>Bumper, front</td><td colspan="2">General Steel Castings</td></tr>
<tr><td>Cab apron</td><td>General Steel Castings</td><td>Alan Wood & Co.</td></tr>
<tr><td>Cab windows</td><td colspan="2">Prime</td></tr>
<tr><td>Cab windshield</td><td colspan="2">Prime</td></tr>
<tr><td>Compressor, air</td><td colspan="2">Westinghouse, No. 15</td></tr>
<tr><td>Compressor packing</td><td colspan="2">U. S. King</td></tr>
<tr><td>Coupler, engine</td><td colspan="2">McConway & Torley</td></tr>
<tr><td>Flexible joints, brake and steam heat</td><td colspan="2">McLaughlin</td></tr>
<tr><td>Flexible joints, aux-loco</td><td colspan="2">Barco</td></tr>
<tr><td>Gages, air, feedwater heater, steam, steam heat, stoker</td><td colspan="2">Ashcroft</td></tr>
<tr><td>Headlight</td><td colspan="2">Electric Service Supply (Keystone)</td></tr>
</table>

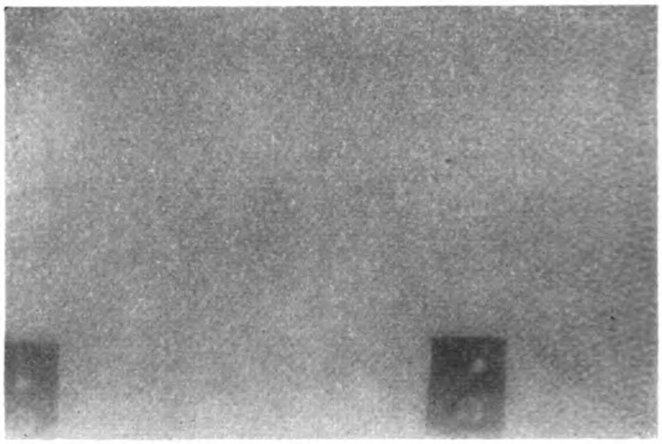
	American	Baldwin
Headlight generator	Keystone	
Lamp, gage board	Pyle-National, LCP-60	
Lamp, back-up	Crouse-Hinds, LD-23	
Paint	Dupont	Mountain Varnish & Color Works
Piping	Reading, w.i., extra heavy	
Pipe unions	Corley	
Run boards	A. W. Diamondette, No. 12 gage	
Safety bar	Franklin Unit (Ewald iron)	
Sanders	U. S. Metallic	
Steam heat regulator	Leslie, 1½ in. by 2 in.	
Train control	General Railway Signal	
Universal joints, cab turret valves	Hancock	
Washer, rail	Hancock	
Wiring, condulet and cab lamps	Crouse-Hinds	
Tender:		
Brake shoes	Diamond S	
Radial buffer	Franklin	
Sprinkler, coal	Hancock, cold water	
Tank hose	Anaconda	
Tank hose strainer	Hancock	— —
Tank valves	Everlasting	
Tender coupler	McConway & Torley	
Tender coupler yoke	Farlow	
Tender draft gear	Miner, A-22xB	
Tender frame	General Steel Castings	
Tender truck journal box	Symington, malleable iron	
Tender truck journal box dust guard	American	Baldwin
Tender truck brakes	American Steel Foundries, clasp	
Tender truck brake regulator	Royal	
Tender truck side bearings	Stucki	
Tender hand brake	Miner D-2928, Ideal Safety Staff	

of front wheels of the rear truck. The tenders have a capacity for 18,000 gal. of water and 28 tons of coal. The coal bunkers are constructed with concave sides, causing coal to flow freely into the stoker trough.

Britain's Fastest Engine Retired.—Great Britain's fastest and most famous engine, the Great Western locomotive, "City of Truro," has been retired from active service. It has not been scrapped, but has been preserved and sent to the York Railway Museum. The "City of Truro" made British and World railway history in 1904 by achieving the highest authenticated speed ever recorded—102.3 m.p.h.—on the run up from Plymouth when competing for the American mail. The engine was, therefore, the first form of locomotion to pass the 100-m. p.h. mark, and even today still holds the official speed record for a railway locomotive. During its 27 years of service, the City of Truro has run 1,000,438 miles and has lately been employed on the Chester to Oxford, Oxford to London, Shrewsbury to Bristol services. The record was the culmination of the great fight between three railway companies for the American mail traffic via Holyhead and Liverpool on the one hand, and Plymouth on the other. The effect of the run and the securing of the ocean mail traffic by the Great Western virtually placed Plymouth on the direct London-New York route, and established it once and for all as the nearest and quickest port of call between the two cities. The "City" class of engines are of the 4-4-0 type. They were constructed in 1903 and 1904 and at that time were the principal passenger engines on the Great Western system, being used on all the main express services, on the special trains run to Plymouth on July 14, 1903, for His Majesty the King and on the first Cornish Riveria Express on July 1, 1904, which resulted from this Royal special.

Radiography of Railway Materials—A Correction

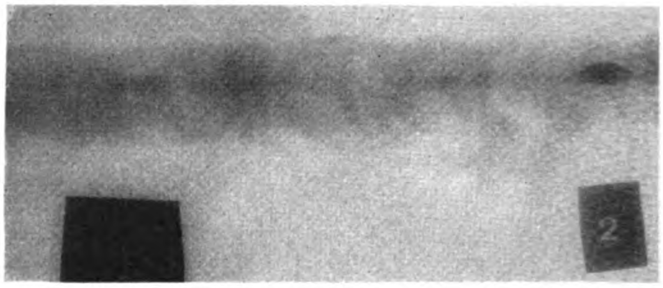
It has been called to our attention that several points in the article by Herbert R. Isenburger on "Radiography Applied to Railway Materials" which was published in the April, 1931, issue of the *Railway Mechanical Engineer*, were not clear. Special reference was



Radiograph of a sound weld in 2-in. plate stock

made to the caption under the illustration in the first column on page 175. Although this casting had been passed by the customer's inspector as being particularly good, the radiograph, as stated in the article, revealed a sharply defined crack starting from a small cavity.

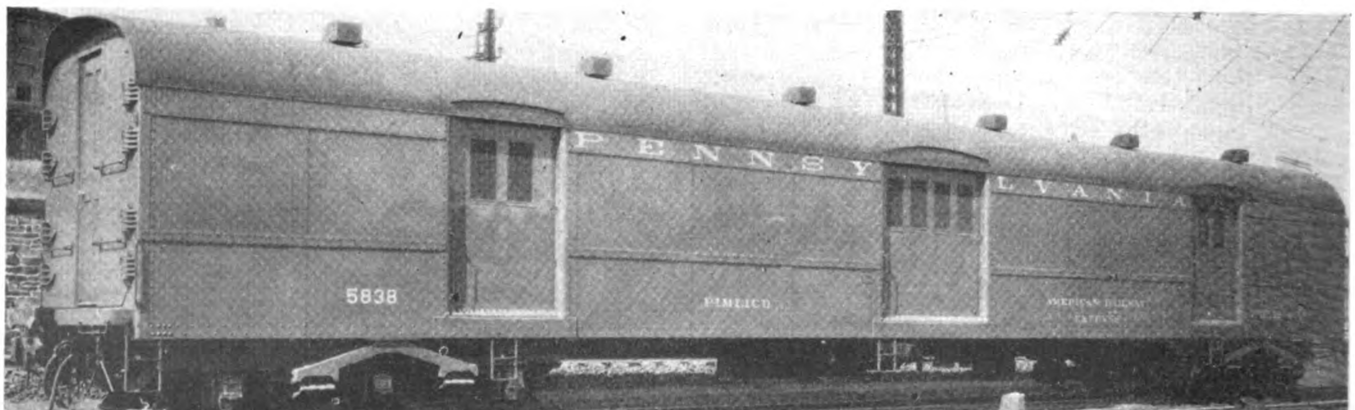
Two radiographs referred to in Figs. 1 and 4 of the



Radiograph depicting an acetylene weld which is rather good

sketch shown in the second column of page 176, and in the first paragraph on page 177 were inadvertently omitted. The radiographs are shown herewith.

* * *



One of a number of horse-express cars used by the Pennsylvania for the transportation of polo ponies and race horses

South African Refrigerator Cars

By W. B. Dawson*

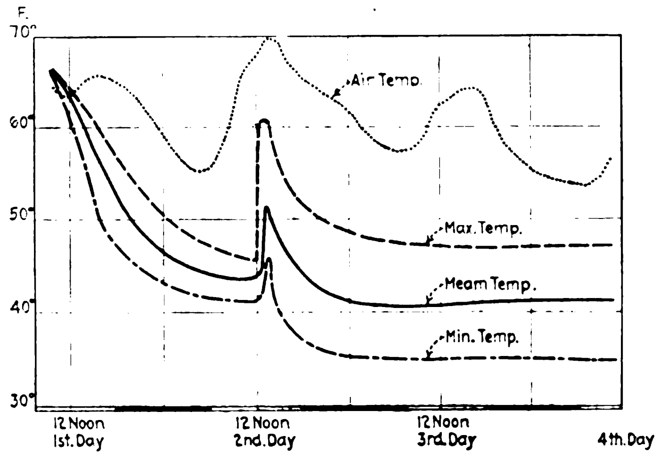
THE South African Railways have developed a refrigerator car with eight ice bunkers built in the roof for the transportation of perishables to Cape Town from points within a 1,000-mile radius. Much of South Africa's export deciduous fruit is grown within easy reach of Cape Town and can be transported safely by rail from the farms to Cape Town in ventilated cars. The necessity for refrigerator cars became apparent when increasing quantities of delicate fruit such as plums, peaches, and pears were cultivated in the vicinity of Johannesburg and Pretoria, necessitating rail transport of approximately one thousand miles from the Transvaal high veld to Table Bay, Cape Town. Unlike America, South Africa does not possess a chain of icing stations along the railway from which refrigerator cars can have their bunkers replenished enroute, nor does the present volume of business justify their erection.

The design of refrigerator cars for the conveyance of perishable traffic over the South African Railways until a few years ago had been based on the American type of car with the ice bunkers at each end. Departure from the conventional design was made when two refrigerator cars with ice bunkers in the roof were built for testing purposes. One of the cars was built with a single roof and the other with a double roof.

Test Results

Tests with the cars demonstrated the superiority of overhead bunkers which, in addition to insuring a lower inside temperature, had the effect of spreading and maintaining the low temperature more evenly throughout the load. This latter factor is important because fruit stacked in the center of the cars with end ice bunkers ripens more rapidly than that more favorably situated with consequent loss due to over-ripeness and wastage. Moreover, the American type of car showed a relatively bad tare-load ratio, local expert opinion being that it could not be loaded safely to more than half capacity with export deciduous fruit because of the liability of the upper layers becoming unduly hot. Another advantage possessed by the overhead-bunker type of car is an increase of about 10 per cent in loading space created by the absence of the end ice bulkheads.

The figures in the table are the temperatures of test loads of perishables conveyed by the end-bunker iced cars and the new refrigerator cars with single or double roofs.



Temperatures recorded in the end-bunker refrigerator car

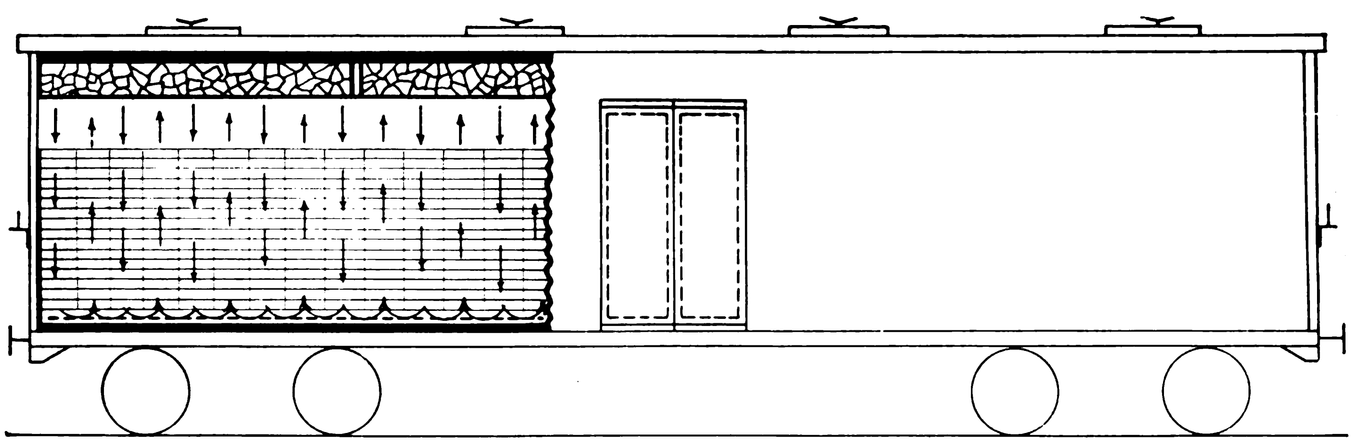
The figures under (b) and (c) are based on averages recorded during several trips made by the roof-bunker cars, while the figures under (a) are averages obtained from records taken in 13 end-bunker cars. These temperatures were recorded just inside the doors, which is perhaps the least favorable position in the car.

Temperatures at Various Points in the Test Loads

	Top	Center	Bottom
(a) End bunker type	51.5 deg. F.	49.2 deg. F.	46.0 deg. F.
(b) Overhead bunker type, single roof	43.3 deg F.	49.2 deg. F.	47.3 deg. F.
(c) Overhead bunker type, double roof	40.3 deg. F.	44.6 deg. F.	42.0 deg. F.

The most important deduction from this table, apart from the general decrease throughout in temperatures, is the fact that, with the alteration in position of the

* Superintendent of Rolling Stock, South African Railways.

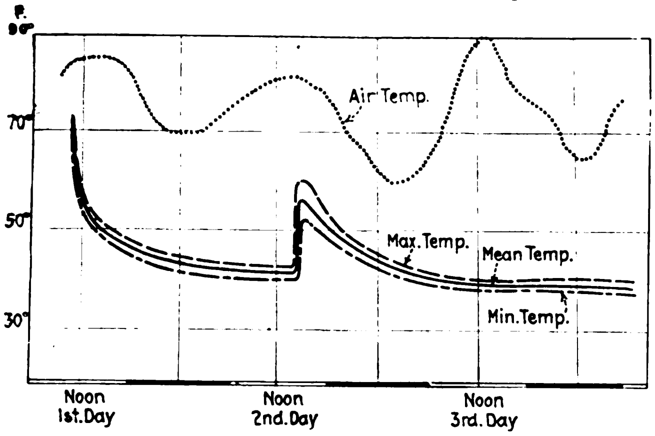


Air currents in the South African roof-bunker refrigerator car

bunkers, the coldest part of the new car is at the top of the load in direct contrast to former conditions, while the warmest section is now situated in the center of the load. The flow of the air currents in the two types of cars is illustrated in the drawings.

In the new cars the difference between the maximum and the minimum temperatures existing in any part of the load is very materially reduced. A feature which was very marked during the tests was the improved radiation of the cold-air currents which produced greater uniformity and stability of temperatures throughout the car.

The highest outside air temperature recorded in the case of the end-bunker type of car was 75 deg. F. at which time the maximum and minimum temperatures in-



Temperatures recorded in the roof-bunker refrigerator car

side the car was 65.5 deg. F. and 50 deg. F. respectively. In the case of the overhead-bunker type, the highest outside temperature was 90 deg. F. when the inside readings were only 35 deg. F. and 34 deg. F. respectively. The tests referred to were conducted with a single-roof refrigerator car. After a double roof had been fitted to a similar car it was found that the outside air temperature had less effect on the readings recorded inside.

Tests Warrant Additional Cars

In the light of the foregoing, the South African Railways Administration decided to adopt the principle of overhead bunkers for its refrigerator cars, and 38 vehicles of this type, with double roofs, have since been built and are now in service. These new cars were put to a severe test during the latter part of 1928 when they were required to convey large quantities of peaches plums and other soft fruits from Johannesburg to Cape Town docks. The fruit was delivered from the various farms to a Johannesburg central cold-storage station where it was adequately pre-cooled and then loaded, once per week, in lots of about 2,000 trays. In the absence of an air-lock at the cold storage plant the cars were iced 24 hours prior to being loaded. Three and a half tons of ice were supplied to each car, which quantity proved sufficient to safeguard the load without recharging before starting the 1,000-mile run to the coast which was accomplished in about 60 hr., including the precooling period.

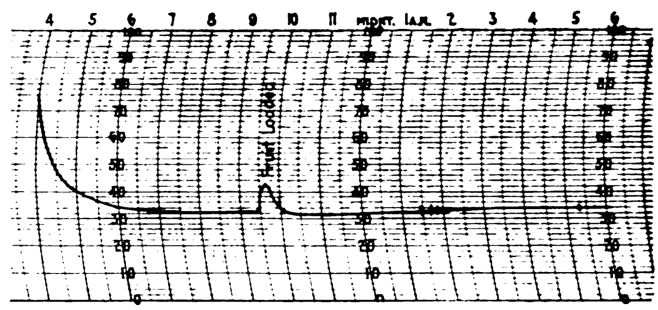
The table shows the temperatures taken at various stages of two consignments, subsequent consignments giving equally good results. All of the fruit was ultimately placed on the London market in excellent condition and brought prices highly satisfactory to the South African farmer.

A Zeals recorder was placed in one of the cars and the record shows the temperature of the fruit at the time of loading, and throughout the journey. The air

Recorder Car Temperatures

Before loading	During loading	5 hr. after loading	At destination 60 hr. after loading
36 deg. F.	50 deg. F.	35 deg. F.	36 deg. F.
32 deg. F.	45 deg. F.	33 deg. F.	34 deg. F.

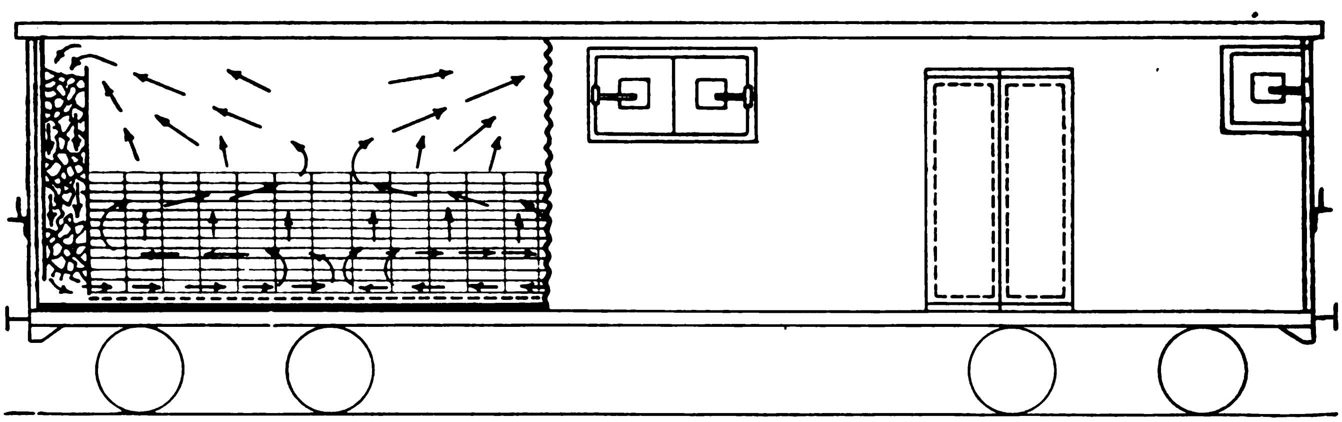
temperature was about 75 deg. F. when the Zeals recorder was placed in the car immediately prior to icing. Although the chart was intended for 24 hr., it was ad-



One record of the temperature inside the roof-bunker car during a journey from Johannesburg to Cape Town

justed to disclose the record of the entire journey from Johannesburg to Cape Town.

[Although the cars herein described are apparently solving the problem of transporting perishables on the South African Railways, ones of similar design, used on American Railroads during the advent of refrigerator cars, proved to be unsatisfactory. The chief objections to their use were their high center of gravity, the unusual amount of lading damage resulting from leaking bunkers and the high maintenance cost of the ice bunkers which were being damaged continually by sliding ice—EDITOR.]



Air currents in the conventional-type American refrigerator car

EDITORIALS

A New Idea In Shop Management

A new idea, or at least one which will be new to most railway shop executives, was advanced by Carl A. Johnson, president of the National Machine Tool Builders' Association, in a recent radio address, when he said that shop supervision, instead of being required to argue for new machinery, should be compelled by the management periodically to justify the continued use of any machinery over a certain number of years old. In this connection, Mr. Johnson quoted the following interesting and suggestive couplet:

"Old machinery in the shop
Shows obsolescence at the top."

It is generally recognized that any machine or piece of shop equipment becomes out of date as soon as another unit is developed which will do more or better work. The question of the continued use, or the replacement, of this obsolete machine then becomes one of relative costs, pure and (not necessarily) simple. The part which modern machinery has played in American industrial progress, as well as the responsibility of management in providing up-to-date equipment, are ably summed up in the following three paragraphs quoted directly from Mr. Johnson's address:

"It has been conclusively shown, many times over, that time-saving machinery raises wages, creates more jobs, and makes available a greater choice of jobs for this and for each succeeding generation of workers. We have, in fact, attained our present standards of living only by the thoroughly American process of constantly improving our machinery, and we can maintain and improve these standards only by rigidly adhering to this policy.

"It has been the practice in most industries for the works manager (shop superintendent, master mechanic, or shop foreman) to ask his management for new machines and be compelled to argue for them. The roles should be reversed. Pressure for the replacement of out-of-date machinery should come from the management down and not from the works up.

"At least once a year, management should procure a list of machines in use, classified by age. Then the works manager should be compelled to prove that any machine over 10 years old can still be profitably used. The simple procedure would disclose some startling leakages of money in almost every plant."

The railroads, as well as other industries, are using a large amount of machine equipment which it would be hard to justify in any complete analysis of operating costs as compared with production secured. In general, with the reduced demand for motive power, the roads are now operating only the newest and most efficient locomotives, and the results are clearly reflected in operating economies. A dollar saved in this way, however, is no more valuable than one saved by the replacement of obsolete machine equipment in shops and enginehouses, and this is a subject in which higher railway officers may well take a personal interest.

In spite of the fact that most railroad shops are not being pushed for high production at the present time, there is a distinct urge for reduced unit cost, which it is unreasonable to think can be kept at the desired low level with much of the machinery now used in railway shops and engine terminals. The need for improved shop machinery and equipment is great, a fact substantiated by recent studies completed by the *Railway Mechanical Engineer*, which show that the railroads bought 14 per cent fewer machine units in 1930 than in the preceding year. Hardly anyone familiar with conditions would venture to say that the number of machines purchased either in 1930 or in 1929 was sufficient to take care of normal depreciation and obsolescence.

X-Ray Inspection Of Railway Materials

The penetrating power of the X-ray has only been known to science for a little over thirteen years. But during that time the X-ray has developed from an exceedingly useful instrument in the laboratory and hospital to one that is now being used by a number of industries, especially for inspecting materials which are to be subjected to critical stresses. A large part of the credit for the development of the X-ray for industrial purposes must be given to Dr. Ancel St. John who was one of the pioneers in utilizing the X-ray to improve the quality of forgings and castings.

The Ordnance Department of the United States Army was one of the first to utilize the X-ray to inspect materials. The first X-ray machine it used was of portable construction and had a penetrating capacity of approximately six inches. However, this method of inspection enabled the designer of ordnance equipment to reduce the factor of safety in many cases as low as 1 and 1.5. What has been accomplished since the pioneer efforts of Dr. St. John and the Ordnance Department at Watertown Arsenal, was described in an article "Radiography Applied to Railway Materials," which appeared in the April, 1931, issue of the *Railway Mechanical Engineer*, page 174.

The non-destructive testing of critical structures, such as those used in locomotive construction, is becoming of increasing importance, particularly with respect to certain applications of welding. It has been the general practice to design the various parts of a locomotive with a sufficiently high factor of safety to allow for any probable defects in material or workmanship. This factor varies anywhere from three to five according to the nature of the load. Naturally, a high factor of safety means increased weight. There is also to be considered the fact that parts having a larger cross-sectional area occupy space that is gradually becoming more valuable as the size of locomotives increases and clearance limits remain stationary.

There has been a marked improvement in the status of the X-ray for industrial uses during the past seven years. It was stated editorially in the April, 1924, issue of the *Railway Mechanical Engineer* that, "the work of development has not yet progressed far enough to bring the cost of radiographic examination within practical limits for general industrial application." Now the larger industries are finding many uses for the process and are installing the necessary apparatus for making their own radiographic examinations. For those whose problems are not extensive or who face temporary difficulties only, some of the pioneers have established

laboratories which are prepared to take care of such cases. It is, therefore, now possible to have evaluated any proposed use of radiography without great expense.

Boiler Conditions Now—and Then!

The subjects of locomotive boiler inspection and maintenance in its bearing on operating conditions, and particularly smoke elimination, was discussed at the April meeting of the Smoke Abatement Committee (Railroad Section), St. Louis, Mo. One of the speakers, whose experience evidently covers at least two decades of "railroading," commented on the greatly improved conditions as regards locomotive maintenance and boiler conditions, since the inspection of this equipment and the responsibility for its condition have been in the hands of the Bureau of Locomotive Inspection, Interstate Commerce Commission.

Some of the older boiler inspectors and supervisors, enginehouse foremen, master mechanics, etc., will recall numberless expedients, by means of which they were enabled to "get by" and keep locomotives in service in former days. Before the advent of the 16-hour service law, maintenance forces at terminals, as well as locomotives, worked long hours and motive power conditions were far from satisfactory. Part of the equipment carried on a locomotive at that time consisted of a box of tapered flue plugs, together with a rod for their application, and it was not unheard of for 50 per cent of the boiler tubes to be filled with these plugs in an effort to stop leaks. Bran or sawdust was also carried to stop leaks, railroad companies sometimes paying bills monthly to mills along the road for bran and similar "leak stopping" material. Before the advent of welding firebox cracks were "sewed" with a chain of plugs, which was the only means of repairing cracks.

Bulges in firebox sheets caused by mud burn, bran, sawdust, etc., were cut out and patches applied with patch bolts, excessively caulked. Patches were inset in the back tube sheet to remove the bulged area and cracked bridges, caused by scale and overworking of the tubes. Soft patches were applied at mud-ring corners with the use of bolts and rubber gaskets. Leaky crown bolts and crown stays were caulked until their holding power was reduced to an unsafe degree. A broom or a sheet of tin often served as a convenient shield, deflecting steam and water from the mechanic making repairs to the firebox. Many times, locomotives were operated with an excessive number of broken staybolts and in some instances this condition was permitted to exist for months. Crown-sheet bolts leaked and were cut off, backed up into the water space, the holes tapped out and plugs applied. Excessive numbers of these plugs unquestionably contributed to an unsafe condition of the boiler.

As a result of these and many other similar conditions, the speaker at the St. Louis Smoke Abatement Committee meeting pointed out that accidents and failures were numerous which caused injuries to employees and resulted in the Interstate Commerce Commission's formulating rules and instructions governing the construction, repair and maintenance of locomotive boilers and their appurtenances, approved February, 1911, and put into effect July, 1911, with amendments to cover the entire locomotive tender and appurtenances in March, 1915.

The organized and systematic inspection methods, instituted as a result of the passage of the locomotive boiler-inspection law, were responsible for a notable improvement in boiler conditions. In 1912, 65 per cent of the locomotives inspected were found defective, this figure being reduced to 16 per cent in 1930. The number of accidents per annum decreased in the same period from 856 to 295. As pointed out in the 1930 annual report of Chief Inspector A. G. Pack, there was a decrease of 17.1 per cent in the number of accidents in the past year alone; a decrease of 31.6 per cent in the number of persons killed; and a decrease of 17.9 per cent in the number of persons injured. While the number of accidents still occurring renders it inexcusable for railway men to "rest on their laurels," the results already accomplished reflect substantially improved and, hence, highly commendable, standards of construction and maintenance. If boiler maintenance and operating conditions, common in former years, were permitted today, it is easy to predict what would happen to the present relatively huge boilers carrying previously undreamed-of pressures!

Grinding Locomotive Journal Bearings

At various times during past years it has been suggested that railroads could add considerably to the life of journal bearings by grinding them instead of finishing them by burnishing. These suggestions have been made in the belief that the savings which could be effected would, within a short time, pay for the cost of installing the necessary grinding equipment. When an axle is turned it is necessary, in order to get the best results, to have the cutting tool pass beneath the low spot on the journal. In finishing by grinding it would only be necessary to remove sufficient material to eliminate the low spot, thus not only saving material and increasing the life of the axle, but also producing a finish which is generally conceded to be superior to that produced by burnishing.

Whenever the question of grinding journals has been brought up objections to it have been raised based on the grounds that fine particles from the grinding wheel might become imbedded in the surface of the journal and cause the bearings to run hot. The extent to which grinding has been employed in railway shops has largely removed any objection of this nature. Locomotive builders have been grinding driving-wheel journal bearings for a number of years with satisfactory results. This, however, is done before the wheels are pressed on the axle, which in itself is not exactly comparable to the problem encountered in the repair shop.

Recently tests were conducted on the Norfolk & Western to determine the practicability and advisability of grinding locomotive driving-wheel journal bearings. The results of these tests and microphotographs of bearings produced by various means of burnishing and grinding appear in an article elsewhere in this issue. It is interesting to note that the microphotograph of the surface of the bearing produced by grinding closely resembles the microphotograph of the surface of a bearing which has run 50,000 miles. This indicates that the quality of the bearing produced by grinding is far superior than that produced by burnishing. These tests also included the running of a ground journal bearing in a bronze bearing for 12 hours at a speed equivalent to 40 miles an hour in the locomotive. The bearings showed no tendency of heating which would seem to refute any statement that fine particles from the grinding wheel will clog the bearing, causing it to run hot.

The Canadian National also ran tests recently to determine the floor to floor time for re-conditioning locomotive driving-wheel journal bearings by grinding. These tests revealed the fact that 9-in. by 15-in. bearings could be re-conditioned in an average time of approximately 35 min. The tests were conducted without any preparation on the part of the railroad and the operator handling the machine was not fully experienced with handling the equipment. The out-of-roundness of the journals ground could, it has been admitted, have been worse, yet, had this been the case it probably would not have entered into the cutting time as a heavier cut could have been taken.

Such time for re-conditioning journal bearings would undoubtedly result in considerable savings in this work. If the mechanic operating the machine earned an hourly rate of 81c, he would have received slightly more than 47c per pair of wheels. This compares with piece work prices of approximately $1.60 paid operators of journal turning lathes on some roads for turning and rolling the same size journals.

Perhaps the cost for re-conditioning journals do not run as high on all roads as the figure quoted above. However, if a reduction in the cost of finishing journals by grinding can be made, even though it might not be to the extent indicated by the difference of the figures quoted above, it certainly is an item worthy of investigation, especially since the superior quality of the work would tend to increase the service life of the axle and journal.

Piston-Rod And Cylinder Packing

Efficient lubrication plus thorough inspection and maintenance is the price that must be paid to secure good cylinder performance. One road reports that the amount of money saved on piston-rod packing during March, 1931, as compared with the same month of last year more than offset the total cost of all lubricants used on its locomotives during that month. Tests on six locomotives, on which four-months' service from a set of piston-rod packing was considered good performance, showed that seven-months' service could be secured by proper lubrication, and there was no reason why eight-months' life could not be obtained. By making a concentrated drive all over the system, the road has secured a reduction of 389 per cent in the number of piston-rod packing sets used since January, 1930.

With the object of increasing the mileage received from cylinder packing, special attention was paid to the condition of lubricators, choke plugs, drifting valves, and the elimination of oil-pipe leaks. Special efforts were also made to see that the rings were properly fitted and applied. The inspectors kept a close check on piston rods and valve stems, and the enginehouse records were examined and checked for reliability and accuracy.

In a number of instances when cylinder heads had been removed for monthly inspection, the packing was discovered not to be in proper contact with the walls of the cylinder. It was evident that the cylinders had not been calipered before the packing had been applied. No report has been received, in the majority of these cases, of the cylinders blowing. In many instances the bull rings had been allowed to wear down to such an extent as to cause increased wear on the cylinder packing.

The points affecting the services of piston-rod and cylinder packing discussed in the preceeding paragraphs are well-known to all those who are concerned with the maintenance of locomotives. But the very fact that the importance of such detail items in locomotive maintenance are so obvious, is one reason why they suffer neglect while other less obvious matters are receiving close attention. After all, constant application to the fundamentals of good enginehouse practice is what achieves the desired results and leads to progress in the development of methods and materials.

NEW BOOKS

Views and Reviews of the Hot Box Situation—*A correction.*

In a review of this book on page 193 of the April, 1931, issue of the *Railway Mechanical Engineer,* it was noted that the book was published by the Educational Bureau of the Brotherhood of Railway Car Men. This, however, is incorrect as the book is published by the author, T. C. Stewart, 123 North Belmont avenue, Indianapolis, Ind.

Proceedings of the Traveling Engineers Association. *Edited by W. O. Thompson, secretary, 1177 East Ninety-Eighth street, Cleveland, Ohio. 460 pages, 6 in. by 8½ in.*

The table of contents for the 1930 proceedings of the Traveling Engineers Association is so arranged that a ready reference to the remarks made by an individual after the presentation of a paper is found directly under the page reference to the subject discussed. The papers presented were on air brakes, frictional bearings, fuel conservation, locomotive piping, long locomotive runs, and the motive power of tomorrow. Several pages of the proceedings are given to a list of past presidents and the subjects discussed during their administrations.

The Modern Steam Turbine. *By E. A. Kraft, Dr.-Ing., Dr. techn. h. c. Bound in stiff board covers, 7½ in. by 10½ in., 201 pages, illustrated. Published by VDI-Verlag G.M.B.H., Berlin N.W. Price 20 Reichmarks.*

This book which is translated into English has been written, according to the author, with the object of guiding the reader who is interested in steam-turbine design and to give him reliable advice so that he may distinguish the useful from the worthless. The book does not deal with either theory or the general design of the steam turbine, but the author has confined himself to the latest tendencies in turbine construction. In this, he has included a complete description of the Ljungstrom turbine which has been applied to a number of locomotives in Sweden and South America.

The following subjects are covered in the book: Methods of Attaining Higher Economy, which subject is grouped under two heads; namely, Preparation of Steam-Turbine Schemes, and Design. The second general subject, Technical Factors Limiting the Design, is discussed under three subjects; namely, Properties of the Materials, Testing of the Materials, and Stresses. The third part of the book is a discussion of the Principle of Design and the fourth part, the Practical Applications of the Principles of Design. The latter subject is divided into three heads; namely, Turbines for Direct Drive, Turbines for Indirect Drive and Turbines for Very High Pressures. The fifth and last portion of the book covers the general subject of Condensers and Their Auxiliaries.

THE READER'S PAGE

Does This Comply With Owner's Standards?

To the Editor:

I have a car on the repair track with coupler head broken. The coupler has 9¼-in. head, a 5-in. by 7-in. shank, an 8½-in. butt and a 1¼-in. by 5-in. wrought-iron yoke, which is in good condition. The car is stencilled '5-in. by 7-in. shank, 8½-in. butt.'

Does paragraph (a), Rule 17, permit me to apply an A.R.A. type D coupler with a 5-in. by 7-in. shank, and a 9⅛-in. butt and to stencil the car, 'A.R.A. Type D coupler' and bill owner? Is it also permissible to apply a 1¼-in. by 5-in. by 9⅛-in. wrought iron yoke and scrap the owner's 8½-in. yoke, or must I maintain owner's 8½-in. standard?

Rule 17 is not clear to me on this question.

E. E. Hosea.

Master Mechanic Is Wrong About Foremen's Organizations

To the Editor:

On page 85 of the February issue you publish a reply signed "Master Mechanic," in answer to the query "Which Man Would You Hire?"

It would certainly be interesting to the foremen on our railroad to meet the type of man who wrote this. It must be that he fully intends to live up to his title "Master Mechanic," or should he have signed himself "Master Mind," for it is hardly to be expected that any gray matter is left to distribute to the foremen.

The *Railway Mechanical Engineer* has for years been a strong advocate of co-operation between management and foreman, also between foremen and men. Now it is quite evident that Master Mechanic does not want this. His men must be mere automatons; no suggestions wanted. I should like to know, when he invests some of his wealth, whether he invests it in some unorganized industry that is one-man controlled or in some well organized company with a board of directors who hold the "once a month meeting" to exchange ideas and discuss future policies. It is possible that these directors might discuss ways and means of more production or better prices, for their own benefit, which might damage the president's or master mechanic's prestige.

It is doubtful if any business of note is conducted without organization in this day and age. In fact, organization is the key to the success of American industry.

The foremen on our road have an organization sponsored by the officers and, of course, the objectionable feature of personal gain has a place in their meetings. But, in addition, the following subjects are featured: Safety first, fire prevention, distribution of raw and finished material, distribution of men, department delays, department problems, mechanical problems, mechanical failures, shop unit production, etc. Welfare work is at present a feature of the organization.

Supply men have realized the importance of the foremen in the success or failure of their products and are frequently seen at these meetings explaining the operation of their various devices.

Again referring to the subject "Which Man Would You Hire?", give me the organized man who not only has the benefit of personal experience, but also the benefit of the other fellows' experience. The old adage "Two heads are better than one" still stands, even if they are only the heads of foremen.

Foreman.

Old-Time Air Jammer Replies to His Critics

To the Editor:

I see where some of my fellow workers and brothers in crime have taken exceptions to my article "Dirty and Inoperative, Why?" which was published in the March issue of the *Railway Mechanical Engineer*.

Well, I expected that some one would criticize me and I note that my old friend "Car Foreman" was the first to do so. Let's walk over to the rip track and see him.

"Hello, Car Foreman, how are you? What do you say now? Haven't heard from you in a long while. The last time I heard from you, you had one of our cars on your rip track that, just fifteen days before, had come out of our shops.

"This car had a new cylinder and reservoir, also a new K-2 triple. For some reason or other you condemned—not only called it inoperative but also showed it as dirty. Just what was really wrong with the brake? It was inoperative, yes, but what caused it to become inoperative? you say, referring me to case No. 1666, inoperative is sufficient. All right.

"When a car comes on your rip track for a pair of wheels what do you show on your original record? 'Worn out'? You bet your sweet life you don't. You show 'worn through chill,' 'tread worn hollow,' 'vertical flange' or what have you. Just send that bill into the accounting department with 'worn out' on it and see how quick you will get it back, and the notation from the chief won't only be 'Why?'

"The air brake game is on the rise and the old days when 'That's good enough' are a thing of the past. Remember when some of us used to put a stencil on both sides of the car so we wouldn't have to run around it to find out what date the brake was cleaned last? Remember how we used to miss one of those stencils once in a while? About two months later you got your bill back from the car owner, and you found where someone else had again cleaned that brake and shown the same stencil you had shown?

"Remember how you used to cuss that your men had cleaned that brake and put your stencil on it, but nevertheless there was that old stencil and in the 'Why made' column was 'dirty and inoperative'? Well, that's all done away with now. The note in Rule 60 fixed that up. Well, so much for that.

"You will note in your A.R.A. Manual of Maintenance of Air Brakes on Locomotives and Cars, Rule 102, that it says, 'a triple valve must be tested with a specified testing device to determine whether it would apply or release properly in both service and emergency application, and if the triple valve fails to pass these tests or brake-cylinder leakage exceeds 12 lb. per minute, the entire equipment must be given the attention specified

for cars requiring annual repairs when stencil is out of date.' You will notice that since the single-car testing device has been put into general use and since the issuance of the A.R.A. Manual our air brakes are 100 per cent better than ever before and our men know that they must educate themselves to these conditions, and the results have certainly been gratifying.

"Well, it's nearly time to go home and I am glad I met you and I hope to see you again some time. In the meanwhile, talk this over with your air brake supervisor and see what he thinks about it and let us have his opinion."

AN OLD-TIME AIR JAMMER.

Discuss Rules at Car Foremen's Meetings? Yes!

TO THE EDITOR:

Just see now how other folks behold us,
Judging from what Mr. Rice has told us.
(Not) By Bobby Burns.

In the good old days referred to by Mr. H. R. Rice in his article entitled "Car Inspectors—Who, What and Why?" which appeared on page 90 of the February, 1931, issue of the *Railway Mechanical Engineer,* I was a small boy going to school and it so happened that one day I was in the room where a class of older pupils were reciting a lesson in Latin from Virgil and my reaction to the proceedings was just about the same as Mr. Rice's at the carmen's meeting. I remember that I fervently hoped that I would not have to go to school long enough to get to the point where I should have to make the fool of myself that those older pupils were making of themselves and, sure enough, my schooling did not reach that far. And even now my opinion of Mr. Einstein's theory of relativity is about the same as Mr. Rice's opinion of the carmen's discussions and probably for the same reason.

The mechanical department insists on safety first, so far as equipment failures are concerned. The transportation department and all other agencies concerned with traffic insist on speed at all times. Thus, the car inspector with a hundred rules and the safety appliance laws to work by is the only retarding factor in the whole organization. His work is the point of friction between the two departments. Naturally he comes in for a lot of criticism and the very nature of the work and the conditions surrounding it cause the inspector to feel the necessity of threshing out every question that has a bearing on it, no matter how technical or trivial it may be or how insipid it appears to those who do not realize what it is all about. Discussions of A.R.A. rules objected to by Mr. Rice, serve the purpose of rounding out and maturing the car inspectors knowledge of the rules and his judgment in applying them. Be assured also that in such discussions he will not be able to bring up any "trick" question that is any more tricky than actual cases that he has to handle in his work, often far removed from all sources of information or advice other than his rule book.

The enforcement of the A.R.A. rules necessarily results in delays to traffic. Lack of their enforcement results in greater and much costlier delays, such as transferring the load at the next interchange point or picking up the pieces with the wrecker. Also, in these latter cases, trying to give a satisfactory explanation as to why it was allowed to happen will entirely demolish that "Great I Am" opinion that Mr. Rice's "average inspector" has of himself. Good inspection which, of course, includes application and reasonable enforcement of the A.R.A. rules will never lose traffic; instead, it safeguards traffic on its way and insures, as far as may be, the ability of the carrier to land it at its destination as quickly as is consistent with reasonable safety. This establishes confidence in the carrier's ability to "deliver the goods," and this confidence is the foundation on which all long-haul business success must rest.

Just what would Mr. Rice suggest in the way of facilitating the movement of the car mentioned by him that was to go the short distance from Indianapolis, Ind., to Muncie, Ind., handled by six crews of five men each? Lax inspection or a complete dispensation of the rules of interchange would not cure the trouble. There is nothing new about this kind of movement; no doubt it is the same route that has long been used. It just so happens that the truck and tractor have sprung up to fill a long felt want and the railroads have not had time to make the necessary adjustments that will enable them to supplement their rail hauls with trucks. But this is purely a traffic problem and the railroads may be depended on to solve it in the most practical manner.

It is hard to see how any considerable benefit would be derived from a discussion by carmen of the railroad companies' car-repair programs. They are not consulted concerning such matters and the public expression of their opinions would probably meet with the disapproval of the company.

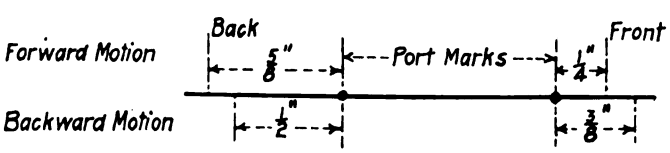
Grant that the rules of interchange are very plainly written and their application seems to be such a simple matter, still the Arbitration Committee has many cases to decide, on which the highest officers of the car departments are unable to agree.

T. J. LEWIS.

Setting Southern Valve Gear—Information Wanted

TO THE EDITOR:

I have been a subscriber of your valuable publication for quite a few years and look forward to receiving it every month. I enjoy reading the valuable information it contains very much. I wonder if I could get some



Port openings when hooked up for short valve travel

information in regard to the Southern valve gear. On some of the heavy power on this road, we have the Southern motion to deal with. What I want is information in regard to setting the valves on these locomotives, in the enginehouse by trailing with another locomotive to quickly figure the various changes or alterations to get the valves square. We understand the Walsehaert and Baker valve gears, but the Southern valve gear is different.

I thought possibly some of your readers may have had some experience with this gear. For example, say the locomotive is moved hooked up for short travel and the marks are something like those shown in the sketch. Where would the proper alteration be made to square the valves? With piston valves, inside admission, this would indicate more than having to change the valve rod. Any information you can give will be appreciated.

THOS. J. MARTIN.

With the Car Foremen and Inspectors

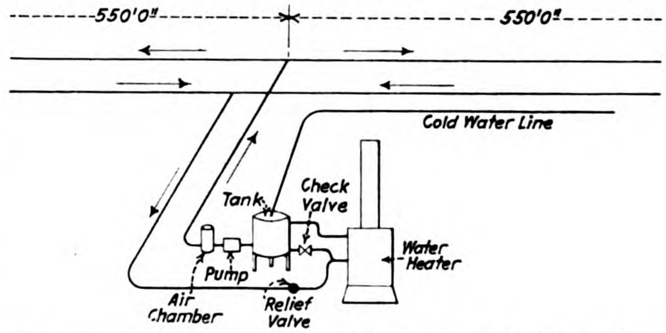
Grand Trunk Western Car-Washing Facilities

*By R. R. McIntosh**

THE problem of cleaning refrigerator and freight box cars economically, for transporting perishables in the first case and high-class merchandise in the second, has received increased recognition on railroads in the past few years. This has been due of course, to closer competition and the necessity for cleaning refrigerator cars quickly and cutting down overhead on box cars by reducing the number of cars marked for rough freight loading, thus placing them in condition for better revenue service by eliminating spots and odors on the interior surfaces injurious to high-class freight.

The Grand Trunk Western has recently placed in service, at its Chicago car repair shops, a new hot-water washing plant which has several new features of design and is a distinct improvement over the method of cleaning formerly used at this point. Experience with the plant bears out previous contentions that hot water, in combination with a cleaning solvent, is one of the best agents available for cutting grease or oil and for deodorizing purposes.

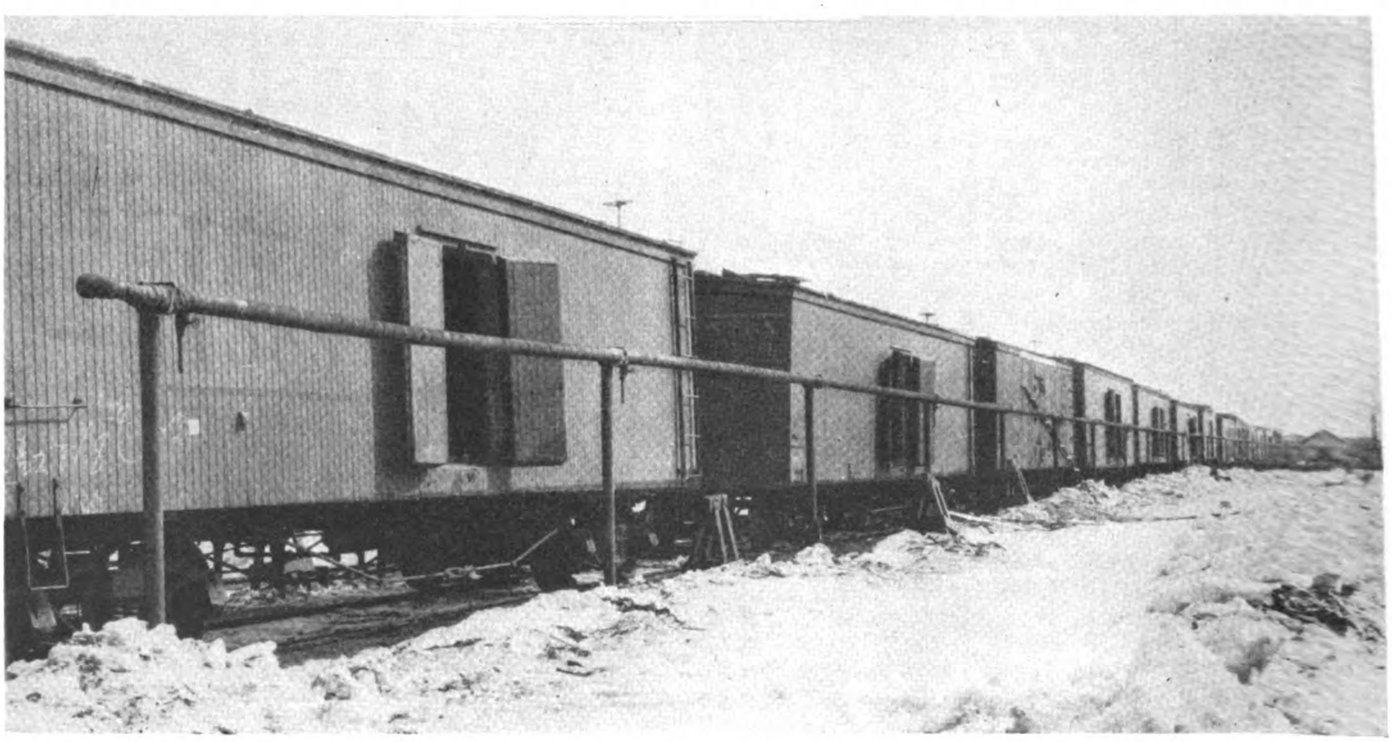
Under the new system, which was designed to cut down the high cost of cleaning cars by eliminating extra car movement and delivering hot water to the cars under pressure, it has been found possible to clean an average of 27 refrigerator cars a day and, in addition, five or six box cars, or a total daily average of 32 to 33 cars, using six car washers, the same as before, with a resultant large saving in cost on the individual cars. This system has been in operation since the middle of December, 1930, and it is worth noting that up to this time a considerable amount of high-class equipment has been placed on a higher-earning basis by transfer from Class C to a higher classification and that none of the cars has been turned back on account of wrong classification.



Diagrammatic layout of the refrigerator-car washing plant

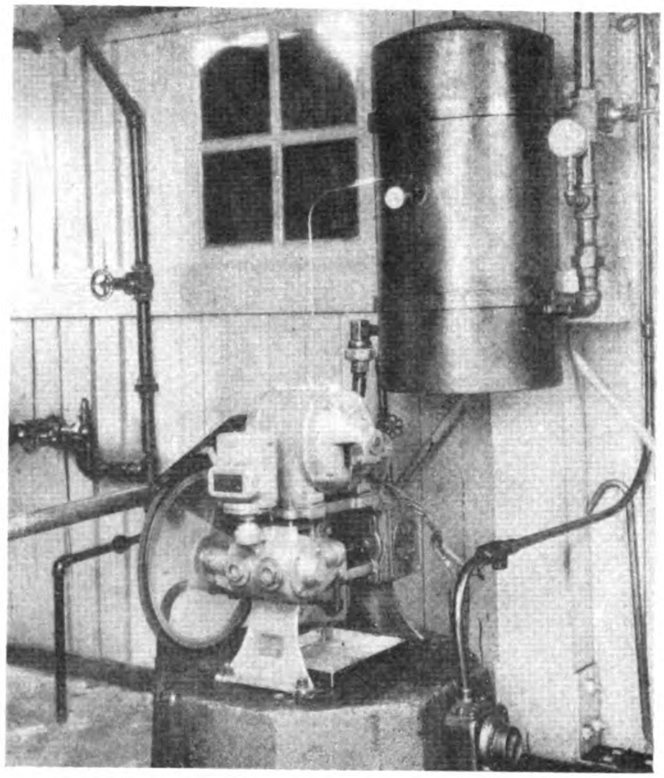
The new plant is simple in design and operation. The first step in its construction was to provide a quick, inexpensive method of heating sufficient water to a suitable temperature to supply the requirements. This was made available by building a hot water boiler from second-hand boiler tubes and plates in such a manner

* Mr. McIntosh is assistant mechanical engineer, Grand Trunk Western Battle Creek, Mich.

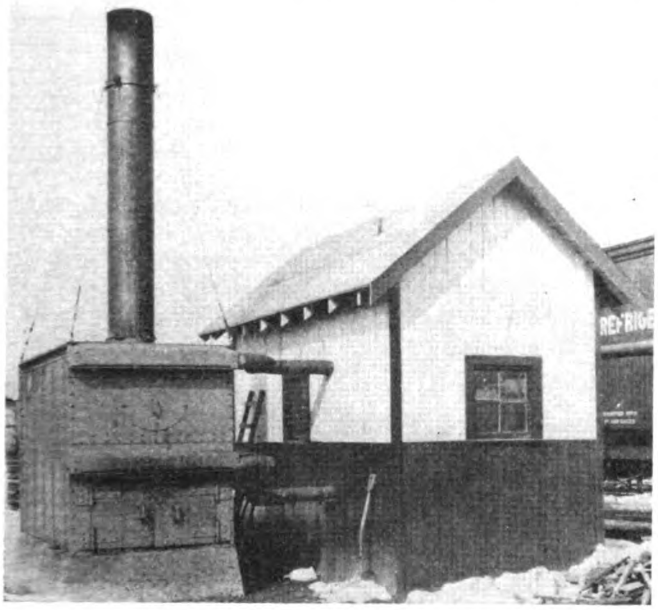

Hot-water distributing and return lines serving the running repair tracks

as to present a large heating surface in a compact space, with the added value of fast circulation. The hot water boiler, illustrated, was constructed on the old ring-type principle of circulation with two-inch tubes welded into four-inch tube headers as the circulating medium, and these were enclosed in a steel casing fabricated from the second-hand plates mentioned above. The interior walls and floor were lined with firebrick salvaged from an old stationary boiler and the baffles were built up of the same material. The four-inch headers were provided with washout plugs at each end. The firebox will accommodate up to 10-ft. lengths of scrap pieces of car timber from car repairs and requires a surprisingly small amount to maintain the water temperature at 170 deg. F. A great deal of refuse is also burned in the firebox.

The second step was to provide ample storage of hot water for all purposes. This problem was solved by utilizing a second-hand heating tank of 600 gal. ca-



The pump and air elimination tank in the pumphouse



Hot-water boiler and pump house

pacity which was on hand at the shops. The coils were removed and an open vent welded on the upper end of the tank. Top and bottom connections were made to the corresponding openings on the headers of the hot water boiler, and the circulating and heating arrangements were complete. To maintain the correct water level in the tank, a cold water supply line with automatic float valve was introduced near the top.

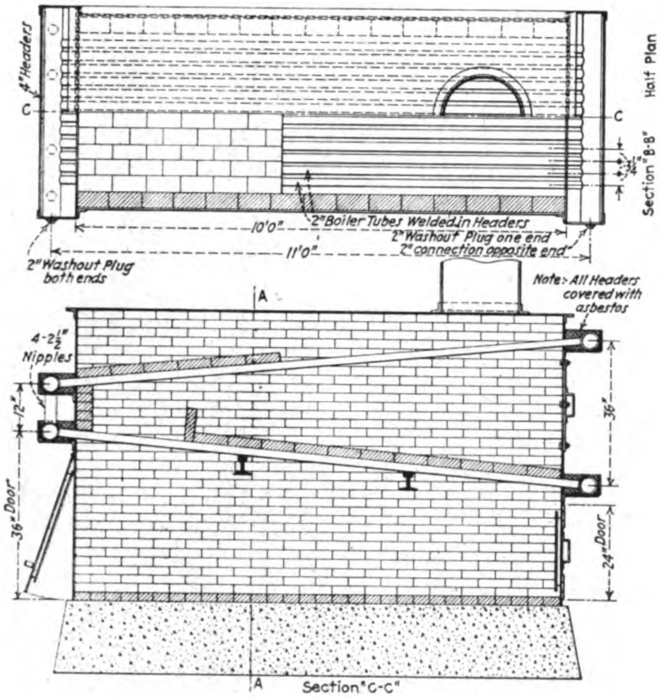
A pump of sufficient capacity and pressure was next installed to furnish hot water to the proposed distributing and return lines economically. After due consideration, a Westinghouse, Type W-800, double-acting, duplex, shallow-well pump, chain driven by a ¾-hp. 110-volt motor, was chosen, and was equipped with hot water valves for the special service required. This is an ordinary house or cottage pump, such as is used for serving two garden hoses with ¼-in. nozzle openings, and, with 60 to 70 lb. pump discharge pressure there is 10 to 15 lb. pressure at the nozzle with a velocity sufficient to throw a stream of water 20 to 30 ft. The pump has a capacity of 800 gal. of water an hour. An air chamber is connected on the discharge side of the pump to eliminate air binding.

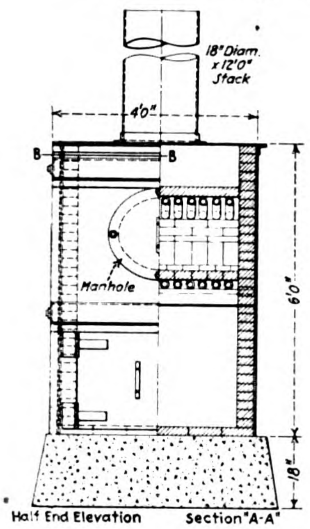
Sufficient second-hand pipe with hair felt insulation and canvas covering was reclaimed from the old steam piping at the shops to erect an overhead distribution system along the running repair track, extending 550 ft. in each direction from the storage tank and pump, with corresponding return lines to the bottom circulating line connecting tank to boiler. A relief valve was set in the combined returns just ahead of the circulating line to maintain the proper pressure. Between the tank and the junction with the return line a check valve was installed, causing the return water to circulate under overflow pressure through the hot-water boiler and allowing the tank water to flow only when the head of water in the tank is greater than the overflow pressure. This insures a rapid flow of water to aid boiler circulation.

The piping was supported at a height of approximately eight feet from the ground on four-inch boiler tubes, reclaimed from a scrap horizontal return tubular boiler and installed vertically in small concrete foundations at 20-ft. intervals. The entire outside run of piping was installed quickly and cheaply by welding all joints, and expansion and contraction are permitted free movement by the fact that the pipe rests on horizontal rods passing through the top of the uprights. The hose connections are ¾-in. in diameter and are welded into the distributing line at suitable points, furnishing ample facilities not only for the running-repair track but also on three adjacent tracks, if desired by increasing the hose length.

The system has been a success from the start of operation. It has been found that from eighty to eighty-five per cent of the refrigerator cars cleaned need only be washed vigorously with the hot water under pressure. The labor cost of renovating these cars has been reduced greatly, due to the rapidity with which the work can be performed.

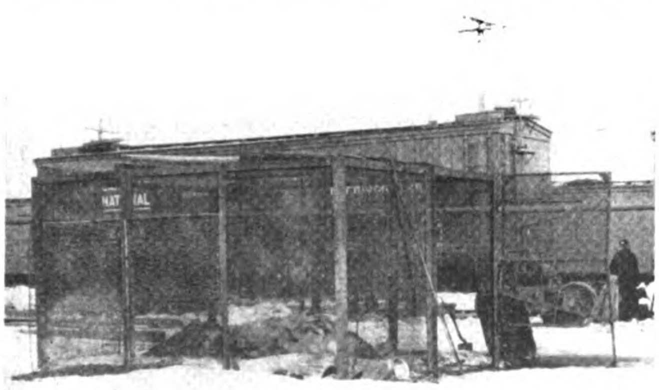
The method of procedure with a box car in bad condition, after all refuse has been removed, is to mix 10 lb. of Wyandotte cleaner with 5 gal. of hot water in a sprinkling can. This mixture is stirred until it en-





Details of construction of the hot-water boiler

ters into solution and is then sprinkled over the surface to be cleaned, lightly on spaces comparatively free from spots, and heavily on places where there are spots hard to remove. The mixture is allowed to soak into the wood a sufficient length of time, as determined by experience, to penetrate some distance and loosen up the substance it is desired to remove. The surface is then scrubbed briskly with a stiff brush and the matter in the wood is brought to the surface and washed out with the hot water from the storage tank. Drying is then hastened by wiping off the surface with a squeegee. It has been found possible to clean cars which have been loaded with hides, oils, coal, bone fertilizer, mustard, lime, cement, plaster and creosoted ties and return these cars to service with classification for high-class freight.



Incinerator where refuse from the cars is burned without danger of giving off sparks

Where the cleaner is used in refrigerator cars, the same solution is used. The racks are lifted up in sections and placed in a standing position on the opposite side of the car while the floor and lining on one side is cleaned and washed. The bottoms of the racks are then cleaned and the racks replaced. The same operation is followed on the opposite side. The tops of the racks are scrubbed when they are replaced and the whole car is then flushed out with hot water.

The average cost of cleaning cars, both refrigerator and box cars, has been reduced to a nominal figure, due to the ease with which water is heated to a high temperature and delivered to the car, and to the large increase in the number of cars washed daily with the same labor as was used previously on a smaller number.

All work is done on the running-repair track except in special cases where the car happens to be spotted on one of the three adjacent tracks and it is not desired to make the extra movement.

The system is adaptable to large and small repair tracks by enlarging or reducing the size of boiler, storage tank and pump, and the first cost can be lowered on smaller installations by eliminating the distributing and return lines and using several lengths of hose directly from the pumping station.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Wheels Mounted Improperly

Pennsylvania Tank Line car 5087, in leased service of the Texas Company, was repaired by the Atlantic Coast Line at Charleston, S. C., on September 7, 1928, and November 14, 1928, the repairs included two pairs of new wheels, at R. & L., 3 and R. & L. 4 on the respect dates. The Pennsylvania Tank Line requested a defect card from the A.C.L. on the authority of joint evidence dated January 11, 1929, covering two pairs of wheels improperly bored, causing them to be out of gage. The improper repairs were corrected by the Southern on authority of the joint evidence. A.C.L. refused to give a defect card covering the wheels at R. & L, contending that the car owner was not entitled to protection on the basis of improper repairs prior to August 1, 1929, as set forth by A.R.A. Rule 81. It also refused to grant a defect card covering the wheels at R. & L. 3, contending that the claim should be withdrawn, since the alleged wrong repairs were made on September 7, 1928 (the car returned home three days later) and the joint evidence was not secured until January 11, 1929. The Pennsylvania Tank Line stated that the joint evidence, in the case of the wheels removed at R. & L. 3, was not secured

within 90 days after the car returned home, because the nature of the defect is such that it could not be detected until some evidence of uneven flange wear had manifested itself. When the defect was discovered, the wheels were so badly out of gage that it was necessary to remove them for this reason alone, and the Pennsylvania Tank Line contended that the A.C.L. should be responsible for wrong repairs.

The decision rendered by the Arbitration Committee is as follows: "The Atlantic Coast Line Railroad is responsible for the improperly mounted pair of wheels applied at location R. & L. 4, in accordance with the joint evidence which was obtained within the required time limit and with due regard to the fact that no other defects were involved. Claim of improper repairs on the other pair of wheels is not sustained, in view of failure to obtain joint evidence within the time limit on basis of Rule 81 in effect on date wheels were removed."—*Case No. 1657—Pennsylvania Tank Line vs. Atlantic Coast Line.*

Car Damaged, Subject to Rule 44

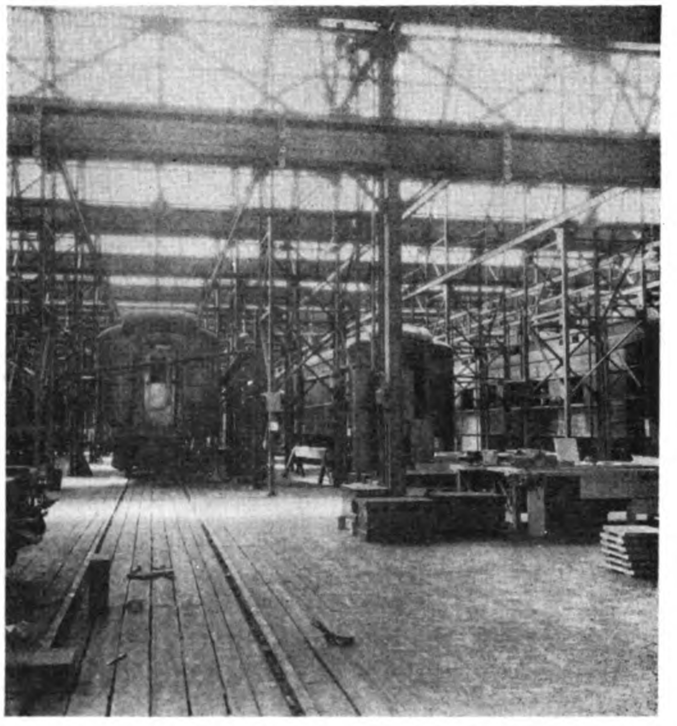
National Tank Car Company car 2308 was repaired January 25, 1929, by the Missouri Pacific at its shops at North Little Rock, Ark. In addition to other repairs there were included two center channels straightened on account of being bent. The Missouri Pacific billed the National Tank Car Company as required by rule 44, contending that the damage was owner's responsibility. It based its contention on the fact that the car was damaged in ordinary train handling and was not subjected to unfair handling covered by Rule 32. It also furnished joint evidence that the condition of the draft sills was the result of progressive deterioration and contended that this was the primary cause of the damage. The National Tank Car Company stated it could not secure from the Missouri Pacific any definite information concerning the circumstances surrounding the cause of the damage as required by Rule 44 and contended that, inasmuch as the provision of Rule 44 had not been complied with, the handling line was responsible.

The following decision was rendered by the Arbitration Committee: "The evidence offered by the repairing line as to the circumstances under which the damage occurred is not sufficient to establish responsibility of the car owner on the basis of Rule 44 in effect at date of the damage."—*Case 1658, Missouri Pacific vs. National Tank Car Company.*

Scaffolding in Coach Shops of the F.E.C.

The Florida East Coast has scaffolding of light steel construction installed in its Miller coach shops, St. Augustine, Fla., in which have been incorporated conveniently spaced permanent ladders and the platforms of which are easy to manipulate. The scaffolding was installed at the time the buildings were constructed in 1926. It will be noted from the illustration showing the interior of the Miller coach shops, that the scaffold structure is built in units consisting of four structural-steel columns, suitably braced, and spaced at regular intervals between the repair tracks.

Each unit is spaced about 9 ft. apart along the repair tracks. The four vertical members of each unit are 4-in. by 4-in. by $\frac{5}{16}$-in. angles, spaced 6 ft. 6 in.



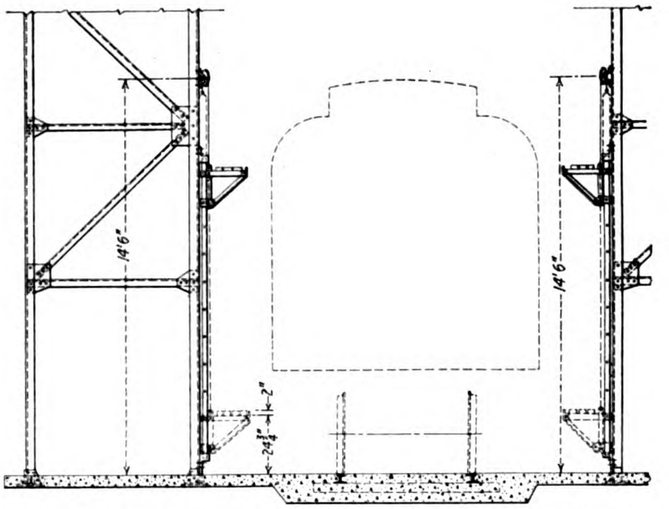
Interior of Miller coach shops of the Florida East Coast at St. Augustine

along the track and 6 ft. 3 in. between tracks. The repair tracks are spaced 22 ft., center to center.

The four vertical members of each unit are braced as shown with $3\frac{1}{2}$-in. by $3\frac{1}{2}$-in. by $\frac{3}{8}$-in. angles. The columns to which the platform brackets are secured, are of 2-in. standard full-weight steel pipe. They are secured to the units as shown, the top and bottom connections being made of cast iron. The bracket pin holes in the pipe columns are spaced one foot apart. With this arrangement, the scaffold bracket has an adjusting range, from top to bottom, of 9 ft.

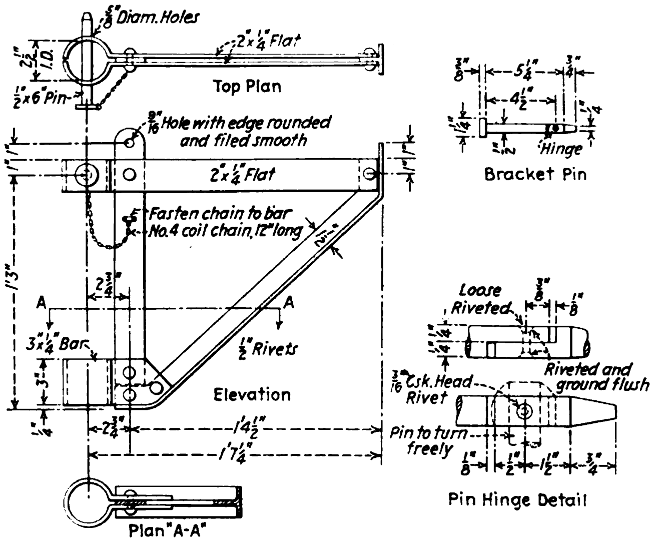
Details of the scaffold bracket and pin hinge are shown in one of the drawings. The bracket is easy to adjust because there are no corners or flat surfaces on which to bind. The pin is secured to the bracket by means of a No. 4 coil chain, 12 in. long.

The scaffold platform is made in various lengths to suit, ranging from 16 ft. 11 in. to 19 ft. 9 in. It is braced on both sides by 2-in. by 4-in. wood members,



Scaffold arrangement as installed in the Miller coach shops of the Florida East Coast

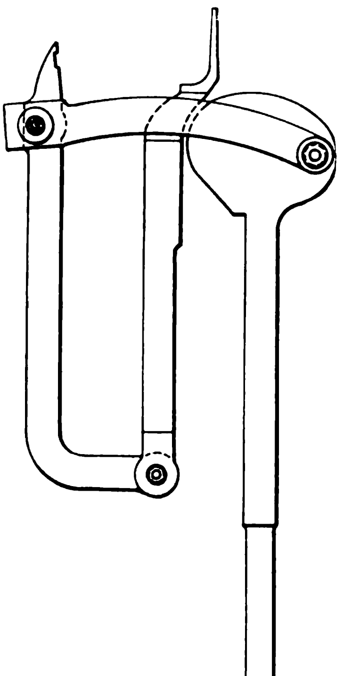
fastened together with ½-in. by 12-in. through bolts. The track side of each scaffold unit is provided with ladders, which extend from the floor to the maximum height of the scaffold platform. These ladders are secured to the outside of one or more of the vertical members of each scaffold unit to suit requirements. They are made of structural steel with round spacers.



Details of scaffold bracket and pin hinge

Applying Springs to McCord Journal-Box Lids

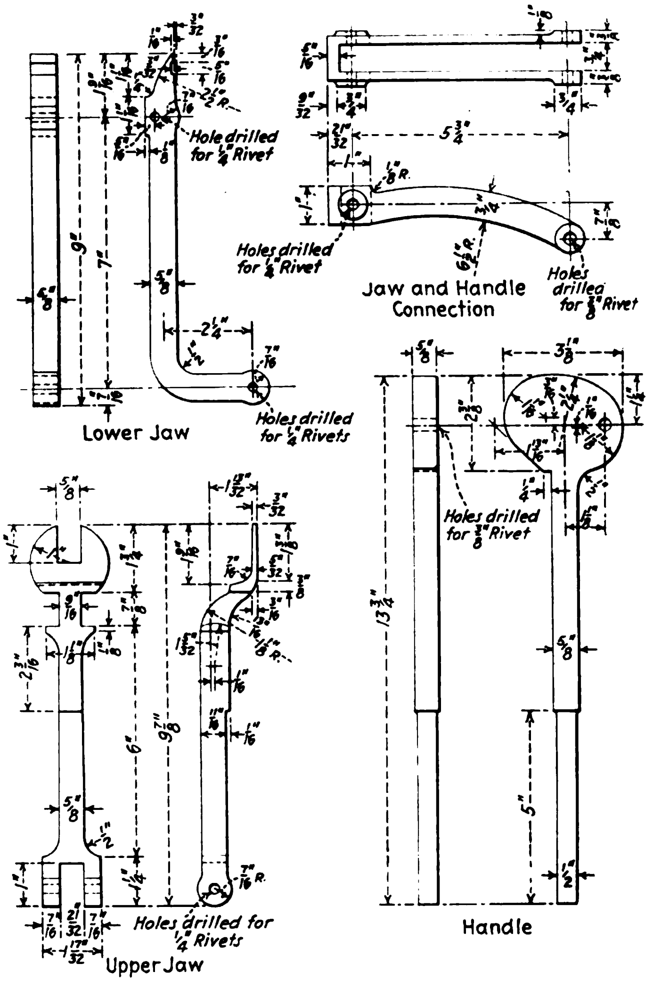
THERE are many cars still in service, the journal boxes of which are equipped with McCord lids having the coil spring and tee pin. The compressing tool shown in the two drawings has been used for a number of years on one railroad for applying the spring and tee pin in car shops and at outlying repair points.



The assembled tool

To apply, the tee pin is inserted inside the spring coil and the cross-arm of the tee pin is then placed in position under the top lugs on the box. The lower jaw of the compressing tool (in open position) is then inserted under the edge of the top lug. The 5/16-in. notch prevents the jaw from slipping off the lug. The upper jaw is placed over the opposite end of the spring and the two jaws are brought together by the cammed head as the handle is moved down.

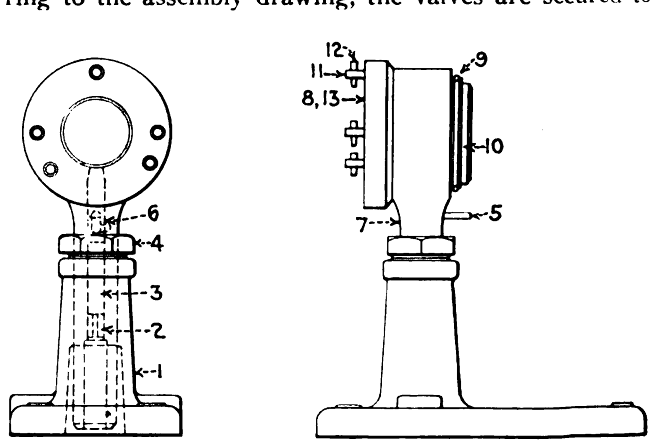
The 1-in. by ⅝-in. notch in the upper jaw permits free movement of the jaw along the tee pin. While the spring is compressed, the lid is lowered to position and secured to the tee pin. The spring is released on completion of this operation. All the parts of this compressing tool are of malleable iron.



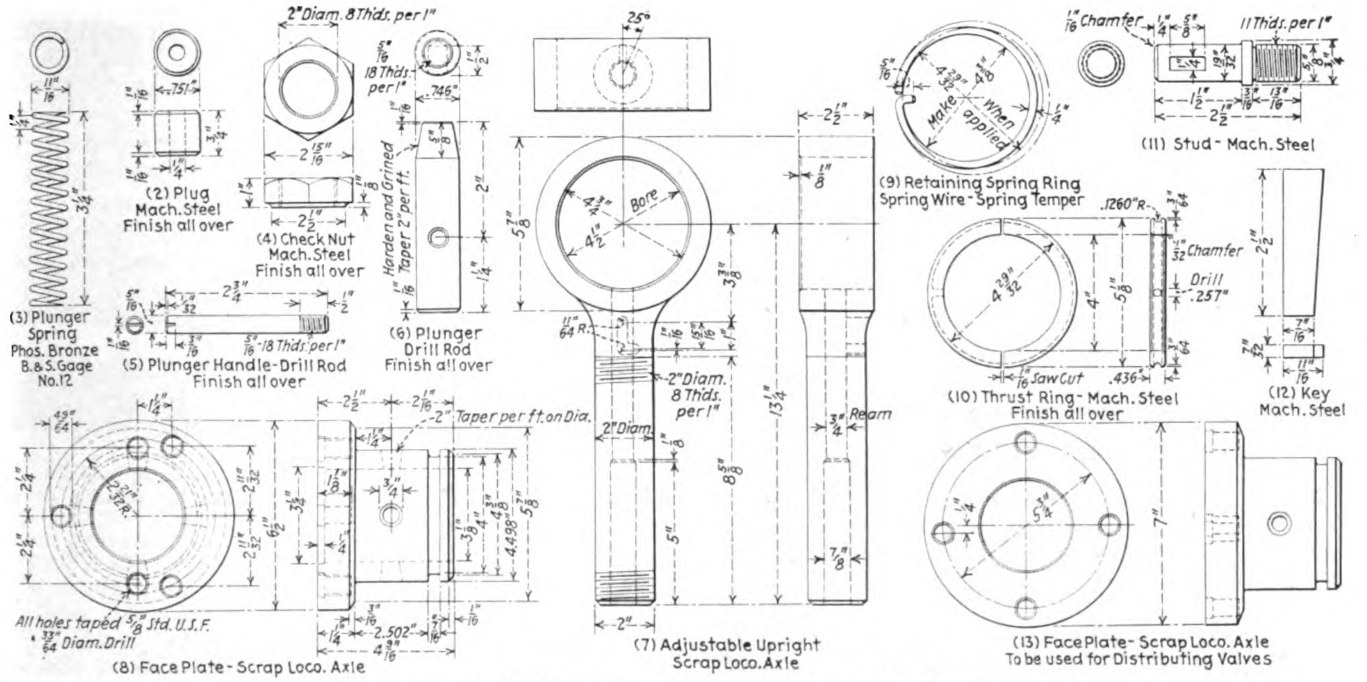
Details of the compressing tool for applying the spring and tee pin on McCord journal-box lids

Stand For Repairing Distributing Valves

SHOWN in the three drawings are the assembly and detail parts of a stand for repairing triple and distributing valves in an eastern railroad shop. Referring to the assembly drawing, the valves are secured to

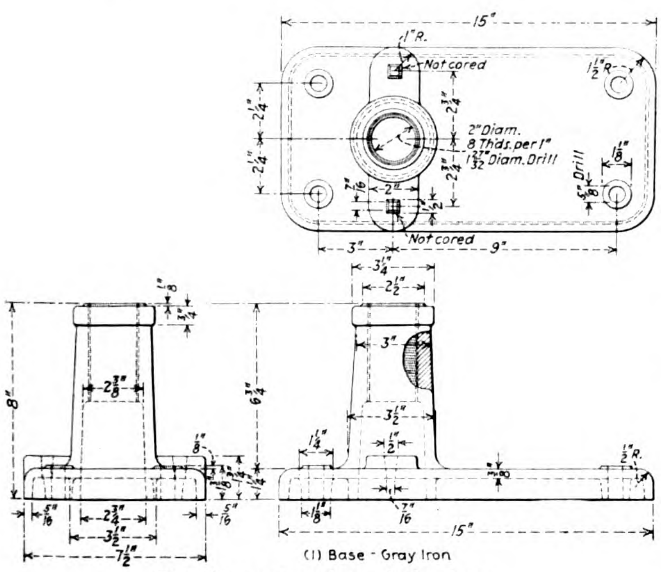


Assembly drawing of the stand for repairing distributing and triple valves



Details of the stand—The numbers correspond with those shown on the assembly drawing

the face plate (13) by means of a stud (11) and a key (12). The face plate can be revolved on the base (1) or adjusted with respect to height, as desired. It is made from a scrap locomotive axle. The back of the face plate is grooved as shown for the thrust ring (10). The thrust ring, which is sawed in half, is held in posi-



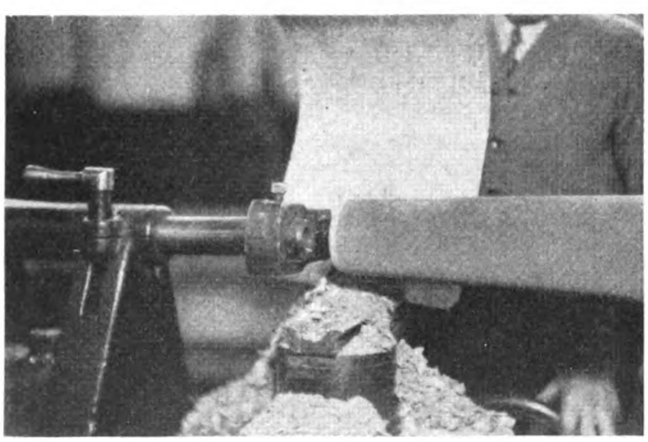
Detail construction of the base

tion by a retaining spring (9). A check nut (4) is screwed on the shank of the adjustable upright (7), as shown. The shank is hollow bored for the plunger (6) and the plunger spring (3). These parts are held in position by the plug (2). The plunger (6) is drilled and tapped to take the 5/16-in. plunger handle (5). It is hardened and ground at the top end to reduce wear. To apply a valve to the stand, the plunger handle is pressed down which depresses the plunger against the plunger spring. This holds the valve in position and allows the workman to use both hands to adjust the valve on the stand and secure the clamping keys. The face plate can be easily removed from the adjustable upright by removing the retaining spring ring and thrust ring.

Turning Taper On Push Poles

IN the planing mill of an eastern road the taper on push poles is turned by merely offsetting the center of the tail stock. The carriage with the cutting tool moves parallel to the bed of the wood lathe, the offsetting of the tail-stock center eliminating the necessity of a taper attachment or the manipulation of the crossfeed of the carriage by the operator.

The offsetting of the center is accomplished by clamping a piece of bar steel to the tail-stock spindle. The piece is machined to the shape shown in the illustration and is fitted with a set screw for securing it to the tail stock. The other end of the piece is drilled and bored to a taper finish for the insertion of the regular center, which is transferred from the tail-stock spindle.



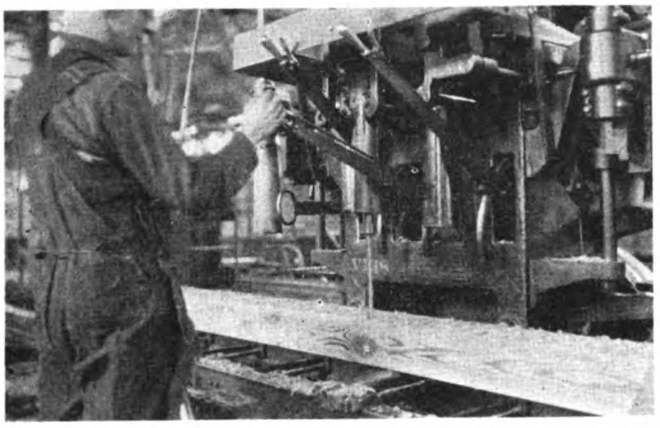
The off-setting of the tail-stock center of this wood lathe eliminates the necessity of a taper attachment or the manipulation of the crossfeed to cut the taper on the ends of push poles

The distance between the center line of the tail stock and the offset center is dependent upon the standard taper used on push poles. On the road where the center was designed, the center is offset 3 in.

After turning the entire length of the push pole to size from the rough, the small center is removed from the tail stock and inserted in the offset hole. The end of the pole is marked where the taper is to begin and the tool is set at that point. When the lathe is started the carriage moves parallel to the bed, cutting the taper. The pole is reversed in the lathe for cutting the taper on the opposite end.

Slotting Decking to Clear Rivet Heads

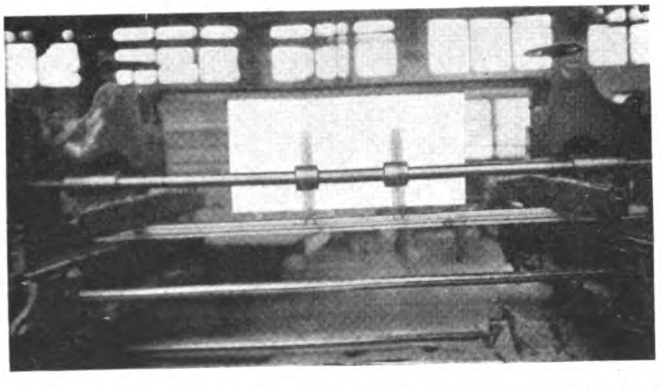
WHEN applying decking on a car it is of course necessary to prepare the boards with slots to clear the rivet heads along the center sill. This is usually done by placing the faces of two boards together



Preparing car decking for rivet-head clearance by drilling

and drilling a hole through the flushed edges, one-half of the hole being in each board. The semi-circular recess thus prepared clears the rivet heads, permitting the decking to be placed evenly along the center sill.

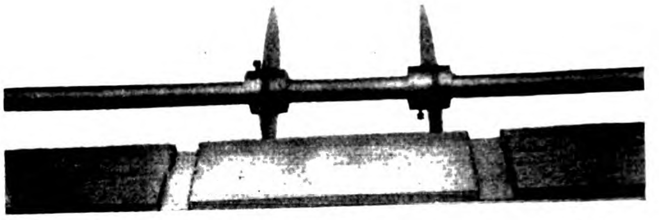
To eliminate the necessity of drilling the decking in this manner, an Eastern railroad shop mounted on the shaft of a circular saw two saw blades set at an oblique angle, the horizontal distance travelled by the periphery of the blade set at this angle being sufficient to cut a slot in the decking of the required width to clear the rivet heads. This saw, because of the peculiar action of the blades while in motion, has been designated as the "wiggle saw." In one of the illustrations is shown



The wiggle saw used for cutting parallel slots in car decking

the parallel slots cut by the blades and also the manner in which the blades are mounted on the shaft of the machine. The decking is fed through the machine continuously on a conveyor, the blades cutting the parallel slots as the planks pass beneath them.

The installation of this saw has resulted in a net saving of 88c per 100 planks prepared for car decking in



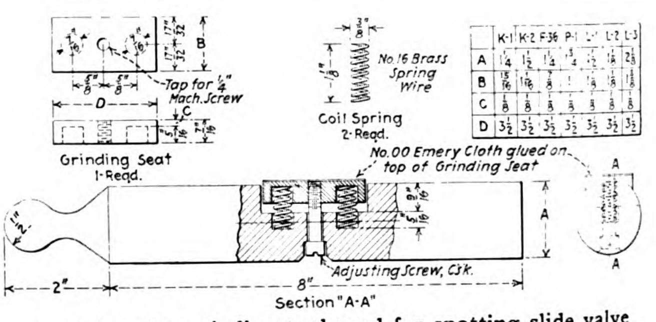
Slots cut in car decking and, in the background, the saw blades mounted obliquely on the shaft, for cutting them

this manner. Comparative illustrations are shown of the two methods of preparing the decking with these slots. In the one illustrating the wiggle saw is shown with a single plank on the conveyor belt to avoid confusion and clearly indicate the operation of the saw blades.

Triple Valve Grinding Tool

IN the drawing is shown a tool for grinding slide-valve seats of triple valves. The tool automatically guides itself from the back of the bushing in the same position that the broach is guided when rebroaching a valve. The tool is fitted with a plate supported on two brass wire springs which forms a grinding seat. No. 00 emery cloth is glued to the surface of this plate. When in use the plate is pressed down to permit the tool to enter the valve bushing.

When the plate is released the face is held against the



A triple valve grinding tool used for spotting slide valve seats in the valve bushing

slide valve seat in the valve bushing by means of the springs. The tool is then stroked backward and forward until a smooth seat is obtained on the valve bushing. The slide valve is rubbed over a piece of No. 00 emery cloth and worked on a face plate until smooth. The slide valve is then inserted in the bushing and ground into the valve seat from which all high spots have been removed by the use of the tool. The average time consumed in grinding a slide valve which has a cut seat is about ten minutes. The tool can be designed for various sizes of triple valves. The dimensions of the tool for various types of triple valves are given on the drawing.

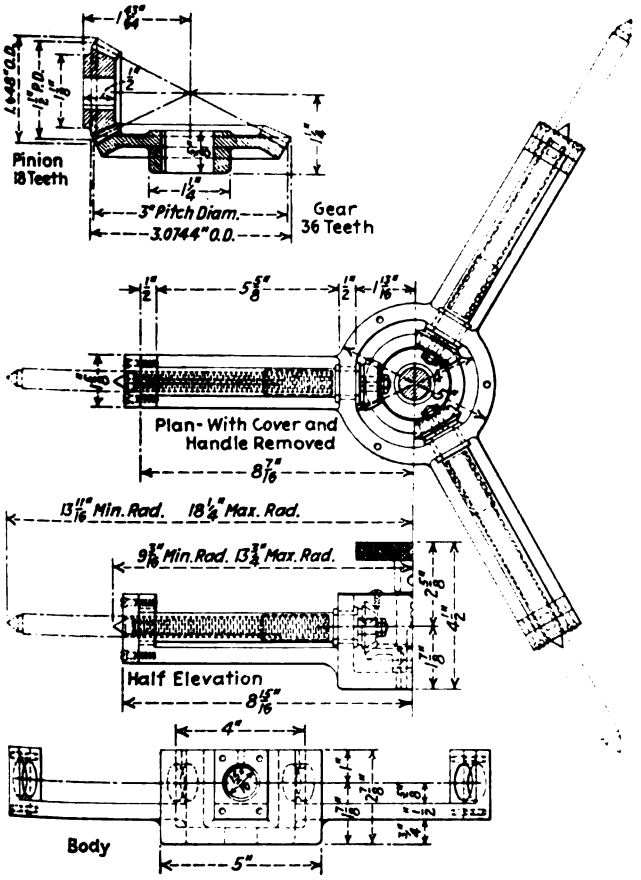
In the

Back Shop and Enginehouse

Gear-Operated Cylinder Center

IN the drawing is shown a gear-operated cylinder center, the legs of which all move out or in simultaneously and equally, thus eliminating the necessity of adjusting and re-adjusting each leg separately until the center is squared in the cylinder. A single 36-tooth gear with a pitch diameter of 3 in. meshes with three 18-tooth pinion gears of 1½-in. pitch diameter. The pinion gears actuate the in and out movement of the legs whenever the main gear is turned. A knurled handle is keyed to the shaft of the main gear for this purpose.

Each leg of the center is comprised of a sleeve, each of which is keyed to one of the pinion gears and tapped out for the insertion of a ⅝-in. screw. For small-diameter cylinders a small pointed head 1⅛ in. long is set in the end of the screw. With this small head, the maximum radius to which the legs of the center can be extended is 13¾ in. while the minimum radius is 9-3/16 in. For cylinders of large diameter a rod is used which measures 5⅛ in. from the pointed tip to the shoulder which sets against the screw. The maximum radius of the center, using this rod, is 18¼ in. while the minimum radius is 13 11/16 in. The gears, sleeves and screws of the center body and legs are fitted with cover plates for the exclusion of dirt.

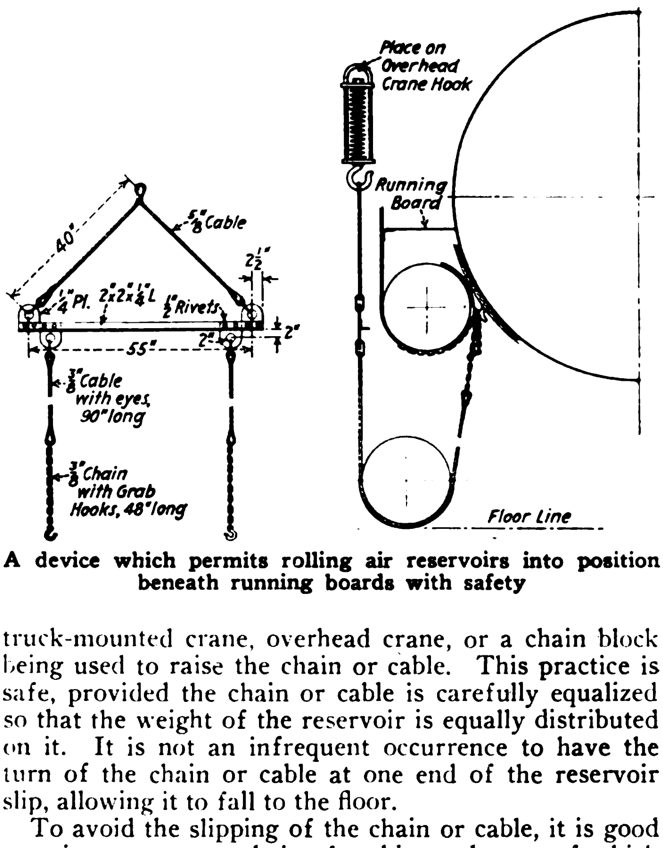


The three legs of the cylinder center move out or in simultaneously, each actuated by a pinion gear which meshes with the main operating gear

When using the center, the knurled handle is turned to the left to draw the legs in so that the center will enter the cylinder. After it is set in the cylinder the handle is turned to the right, moving the legs outward equally until they come to rest against the cylinder walls. Thus the center is accurately set up in place without necessitating the use of calipers to square it.

Device for Lifting Air Reservoirs into Position

AFTER removing air reservoirs in the engine-house it is often difficult to replace them, especially if they are mounted beneath the running board as is most frequently the case. The method usually employed is to roll the reservoir into position on chains or cables, a



A device which permits rolling air reservoirs into position beneath running boards with safety

truck-mounted crane, overhead crane, or a chain block being used to raise the chain or cable. This practice is safe, provided the chain or cable is carefully equalized so that the weight of the reservoir is equally distributed on it. It is not an infrequent occurrence to have the turn of the chain or cable at one end of the reservoir slip, allowing it to fall to the floor.

To avoid the slipping of the chain or cable, it is good practice to use two chains for this work, one of which is attached to each end of a bar, to which, in turn, is attached a sling for hooking the crane or the chain hoist. Such an arrangement is shown in the drawing. This device for raising air reservoirs is comprised of a ⅝-in. cable sling, a spreader bar made of 2-in. by 2-in. by ¼-in. angle iron and a combined cable and chain, 90 in. and 48 in. long, respectively. A spring shock-absorbing device is used between the ⅝-in. cable sling and hook on the crane to take up any shocks which might be incurred when the reservoir is swung into position in its brackets.

When in use, each cable and chain is hooked to the reservoir bracket and is lowered to the floor, after which the reservoir is set in place. As the crane lifts the spreader bar, the reservoir rolls on the cable-and-chain slings until it comes to rest in the brackets. The cable and chain being separated equally by the spreader bar which is always balanced by virtue of the fact that it is suspended from a single point, eliminates any possibility of the cable and chain getting out of position.

Investigation of Surfaces of Locomotive Journal Bearings

By W. E. Wilcox and J. R. Page†*

IT would be impossible to operate modern locomotives over long distances at sustained high speeds if it were not for the efficiency of the bearings. The driver journal bearings are the most important and, since they are very difficult to machine and fit properly, much care must be exercised in this operation. The surfaces of these bearings should be produced as nearly perfect as possible before being placed in service, as the smoothness of the surfaces will increase the actual bearing area and materially decrease the possibility of the bearing becoming overheated.

If the journal bearing is correctly finished and fitted, it will run properly, unless affected by abnormal conditions, such as, improper lubrication, stuck wedges, improper spacing, eccentric loading, etc. If care is not taken in the machining of these bearings, it is very probable that the bearing surfaces will become overheated when first placed in service, regardless of the method of lubrication. Should this occur, it is unlikely that the bearing will ever run cool, but in all probability will continue to give trouble and finally result in a hot box.

In an effort to determine the best method of machining driving wheel journal bearings, we have produced journal-bearing surfaces by all the practical methods of machining and, in order to make a close study of these surfaces, we have taken photomicrographs at 100 diameters which show the condition of the surfaces very clearly. The purpose of this study was to produce a surface on a driving-wheel journal that would compare with the surface of a journal that had been in service for approximately 50,000 miles on a fast mountain-type locomotive which was considered satisfactory for all practical purposes. In cases where the finished journals were run in a bronze bearing, they were run for 12 hours at a speed equivalent to 40 miles an hour.

* Mr. Wilcox is shop inspector at the Roanoke shops of the Norfolk & Western.
† Mr. Page is material inspector at the Roanoke shops of the Norfolk & Western.

Bearing No. 1 represents a surface with smooth finish, water cut. The surface shows considerable pitting and checking due to breaking up of the embrittled, cold-worked surfaces. Surfaces of this kind make very poor high-pressure bearings, as the ridges and high places pierce the lubricating film and cause metal-to-metal contact, which results in a hot bearing.

Bearing No. 2 represents a smooth-finish, water-cut bearing surface, rolled in the same direction as it was machined. The surface shows some improvement, but it is far from perfect and the checking and pitting still stand out prominently.

Bearing No. 2*a* represents a surface that has been machined in the same manner as bearing No. 1, rolled in the same direction, and run in a bronze bearing in the same direction, the object being to produce the effects of actual service on the bearing. The surface shows considerable improvement because in all operations subsequent to machining the axle was rotated in the same direction as when machined. The pits and cracks have been filled and smoothed over, resulting in what we consider a smooth surface.

Bearing No. 3 represents a surface that has been machined in one direction and rolled in the other. This surface shows considerable pitting and checking, because the rough ends of the metal were not pressed back into their original places.

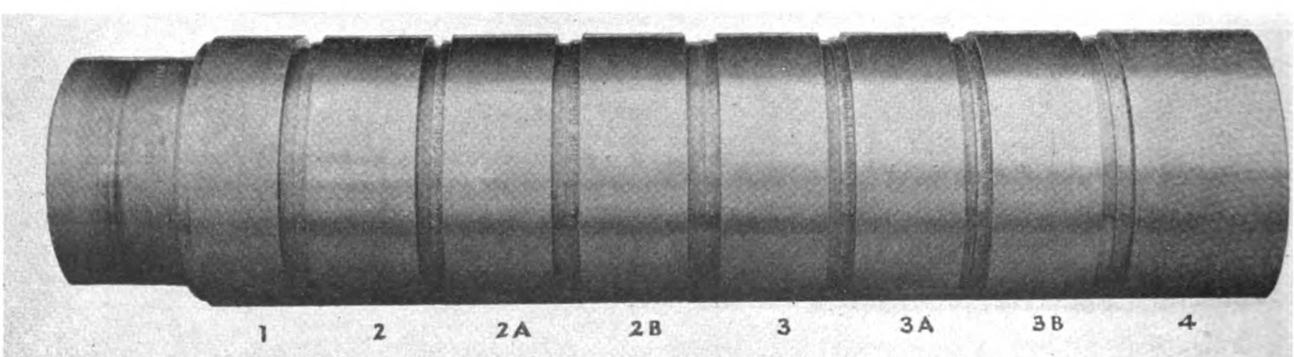
Bearing No. 3*a* represents a surface that has been machined in one direction, rolled in the other and run in a bronze bearing in the same direction as it was machined. This surface shows considerable checking and pitting and represents a surface that could not be considered smooth enough for high-pressure bearing service.

Bearing No. 3*b* represents a surface that has been machined in one direction then rolled and run in a bronze bearing in the opposite direction. This surface is an improvement over bearing No. 3*a*, but shows considerable checking and pitting. This method of finishing does not produce as smooth a surface as when all operations are in the same direction.

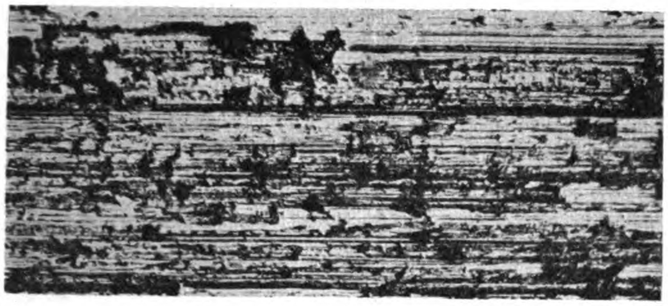
Bearing No. 4*b* represents a surface that has been machined as bearing No. 1 and then ground. This surface is free from pitting and checking and is decidedly smoother than any of the other surfaces produced. The grinding has removed all pits and microscopic cracks left from machining and represents a smooth surface.

Bearing No. 4*b* represents a surface that has been machined the same as Bearing No. 1, then ground and run in a bronze bearing for 12 hours. This is a very smooth surface, free from microscopic cracks, but has not been run in the bearing long enough to remove all the marks left from grinding.

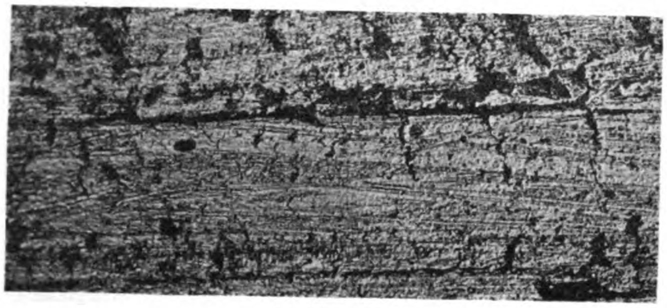
Bearing No. 5 shows the surface of a journal which



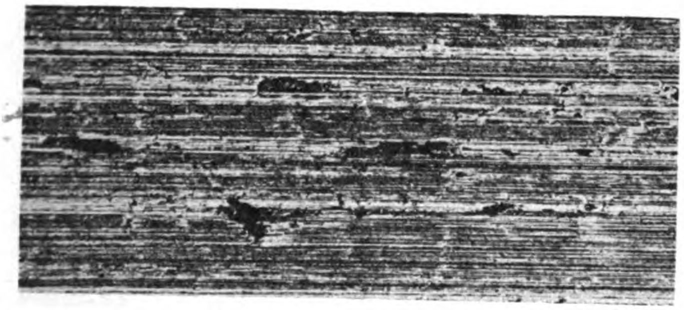
The microphotographs show all bearings with the exception of 2b and 4b



No. 1—Machined←

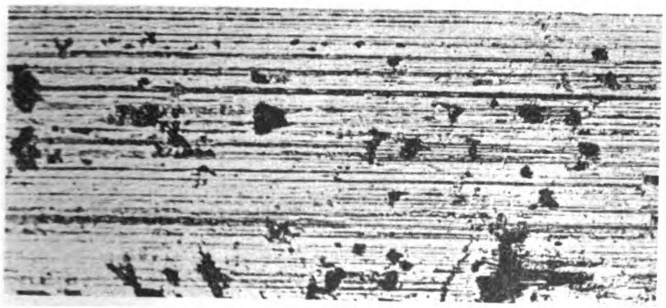


No. 2—Machined←, Rolled←

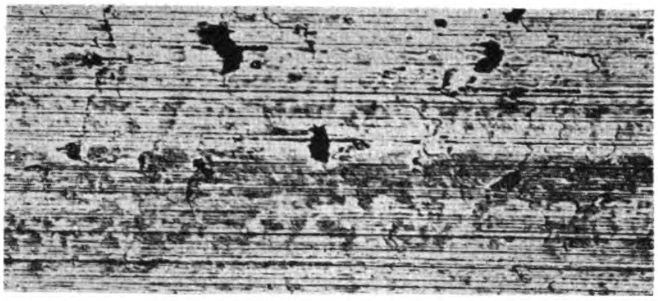


No. 2a—Machined←, Rolled←, Bearing←

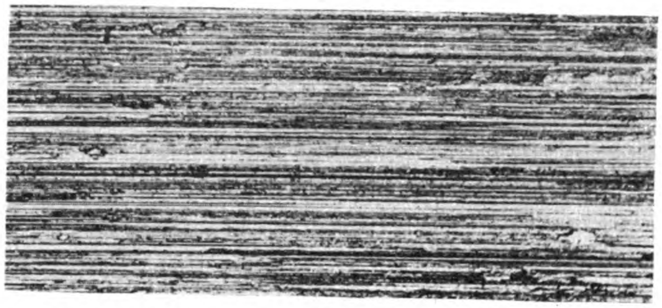
No. 3—Machined←, Rolled→



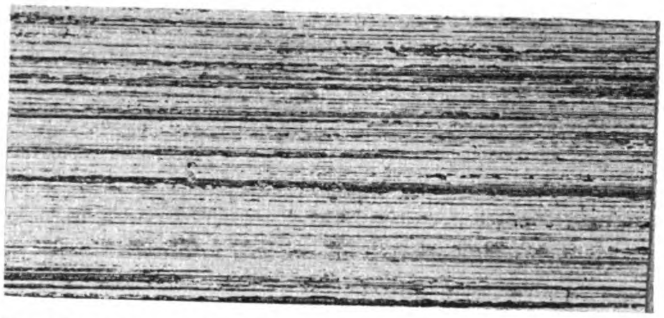
No. 3a—Machined←, Rolled→, Bearing←



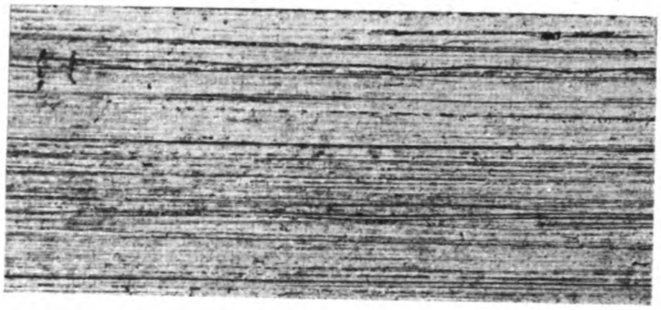
No. 3b—Machined←, Rolled→, Bearing→



No. 4—Machined←, Ground←



No. 4b—Machined←, Ground←, Bearing←



No. 5—Bearing after 50,000 miles of service

Microphotographs of the surfaces of journal bearings produced by all practical methods of machining.—The arrow indicates the direction in which the machining was done—The photographs were taken in order to learn what method of machining produced a bearing surface which would compare favorably with a bearing which had given satisfactory results at the end of 50,000 miles of service—100 diameters

had been in service approximately 50,000 miles on a fast Mountain type locomotive, and was considered satisfactory for all practical purposes. We have produced in Bearing No. 4*b* a surface on a driving-wheel bearing that would compare favorably with this condition.

A check was made with micrometers of the surfaces of Bearing No. 2 and Bearing No. 5 to see if they conform to a true circle, and it was found that the surface of Bearing No. 2 varied as much as .002-in. in diameter, while Bearing No. 5 was a true circle the full length of the bearing with no flat spots or uneven places in it. It was thought that the irregularities in the surface of Bearing No. 2 resulted because it is necessary to use a high rolling pressure to get the required surface. The irregularities in the structure of the metal under rolling would produce the uneven surface on Bearing No. 2.

This investigation shows conclusively that a ground bearing surface is much smoother than the machined and rolled surface, and that it is a true circle, which is not produced with any of the other methods of machining. In shops that are not equipped for grinding journals, the surfaces should be finished as shown on Bearing No. 2, which is the next best method of machining, because the operations are performed in the same direction. Bearing No. 3 would not be considered good shop practice, as the machining and rolling have been done in opposite directions. This does not replace the broken ends of the metal in their original places, which leaves a very pitted surface.

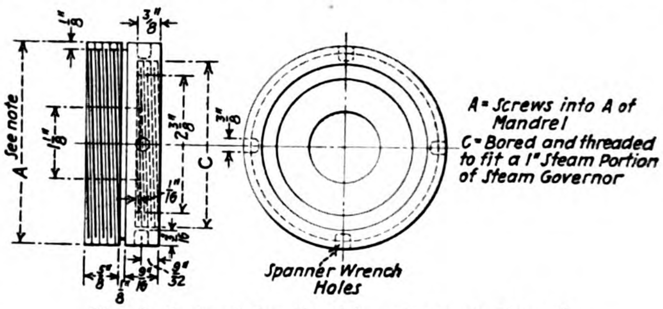
A rolled surface would not be considered as good as a ground surface, because the pits and microscopic cracks have been smoothed over and not removed. Under service conditions, these cracks and pitted places may become uncovered and leave a pitted surface as shown in photograph No. 3. It was also found that, when journals were trued by grinding, considerable less metal was removed than when the journal was turned and rolled. Grinding will greatly increase the life of the journals and materially reduce the cost of locomotive repairs.

Combination Mandrel

By E. G. Jones

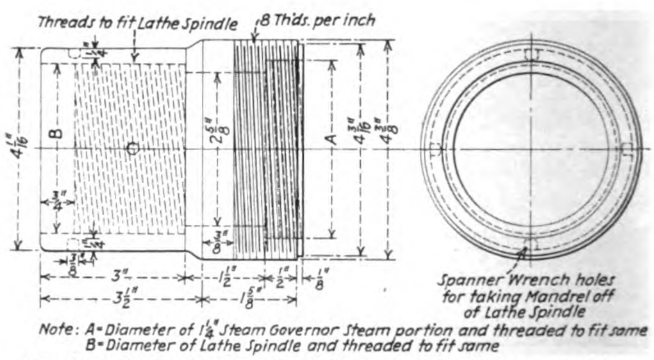
THE combination mandrel shown in the five sketches is one of the most useful lathe tools in our air-brake department where repair work is done in large quantities. Even in small shops such a mandrel can be a time saver where such repairs are made.

By substituting different glands it can be made to hold the steam portions of steam governors of various sizes where they are bored and trued up. Also, by substituting another gland it will hold the various sizes of air-compressor packing and retainer cups when being bored



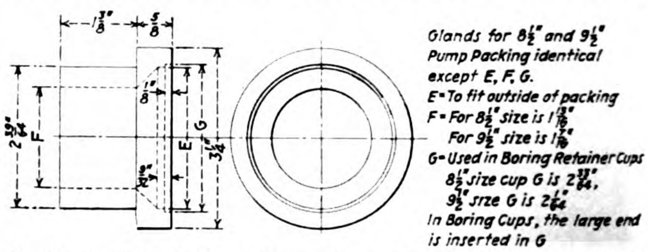
Mandrel gland for the 1-in. steam portion of compressor governors

to fit the piston. Other mandrels which are not shown may be added and applied to the master mandrel for various kinds of work.



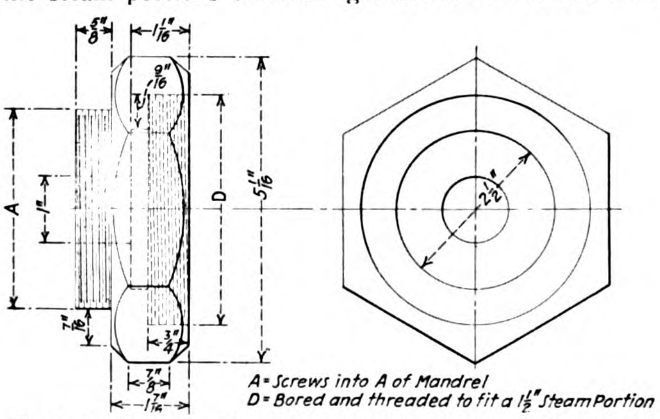
Combination mandrel used for air-compressor packing and the steam portions of governors

The master mandrel is applied to the lathe spindle and the mandrel suited for the particular kind of work to be

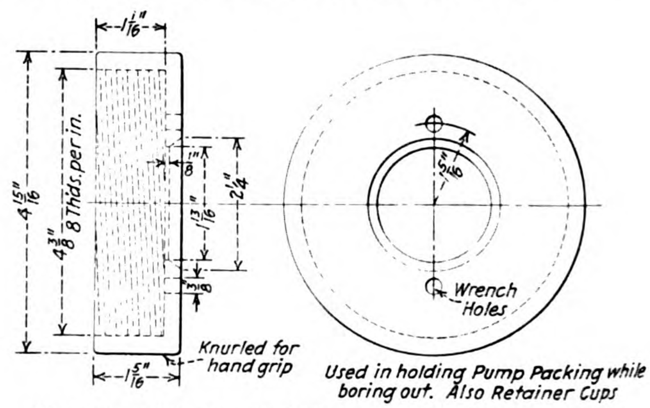


Gland used in boring air-compressor packing and retainer cups

bored is then applied to the master mandrel. This operation is simple and foolproof. It requires no alinement in the lathe and is ideal for production work.



Mandrel gland for the 1½-in. steam portion of compressor governors

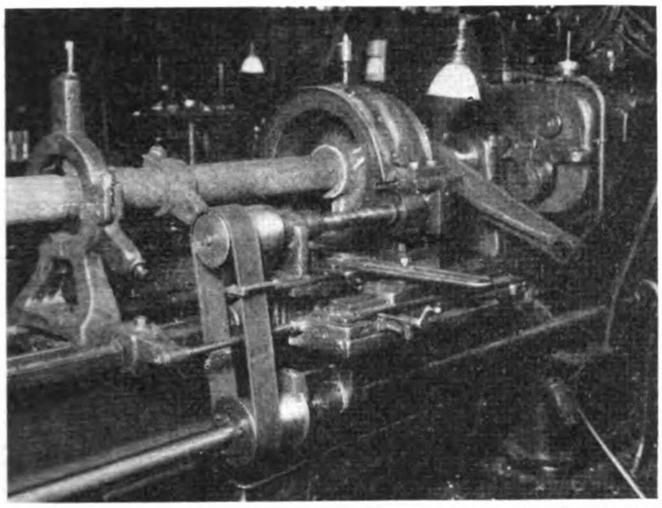


Retainer collar for mandrel used in holding compressor packing and retainer cups while boring out

The combination mandrel and glands are made of steel and finished as shown. The different glands screw into the head of the mandrel as shown in the sketches. The gland used in boring air-compressor packing and retainer cups fits into the mandrel. The packing or cup is inserted in the gland and clamped with the retainer collar.

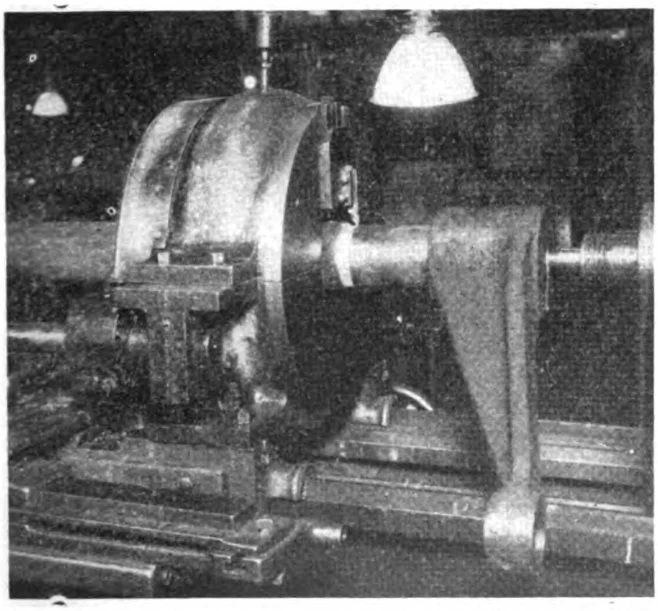
Lift-Shaft Turner

NUMEROUS devices have been used for turning the end and center bearings on locomotive lift shafts without turning the shaft itself, with its large and heavy arm. This operation is handled at the Silvis (Ill.) shops of the Chicago, Rock Island & Pacific by



Device used for turning lift-shaft bearings, used at the Silvis shops of the Rock Island

means of a special lathe device, shown in two of the illustrations. The lift shaft is simply swung between the centers on a lathe and a rotating tool head and brass-lined bearing casting, made in two halves, is bolted around it. The cutting tool is held in a toolpost, capable of hand feeding into or away from the center of the shaft and carried in a revolving tool head which turns in the brass bushing in the bearing casting. This bearing casting is bored out 14 in. in diameter on the tail-stock end, being large enough to receive any of the stops on the lift shaft and thus permit turning a bearing which may be located close to one of these stops. The drive is furnished by tight and loose pulleys from a splined drive shaft on the rear of the lathe, with a shifting lever conveniently located on the lathe carriage. Cross-feed is obtained by the usual lathe-carriage feed screw. The construction of this device is quite clearly illustrated. Its use permits turning lift-shaft bearings accurately and without the labor and time required to press off and on the lift arm or swing the entire shaft in a large engine lathe and turn the small bearings at slow speed.



View showing the rotating tool head and cutting tool turning a lift-shaft bearing

Piston-Valve Puller And Inspection Rack

THE removal of locomotive valves from the valve chambers often requires considerable effort because carbon accumulates between the packing rings and the walls of the spool, bull rings and followers. This accumulation does not permit the rings to compress sufficiently to allow the valve freedom of movement in positions other than its accustomed travel, thus causing it to stick when removing it from the valve chamber. As the present design of most locomotives makes it more or less difficult to get behind the valves to push them out or in front of them for pulling them out, the device shown in the drawing was designed to facilitate this work.

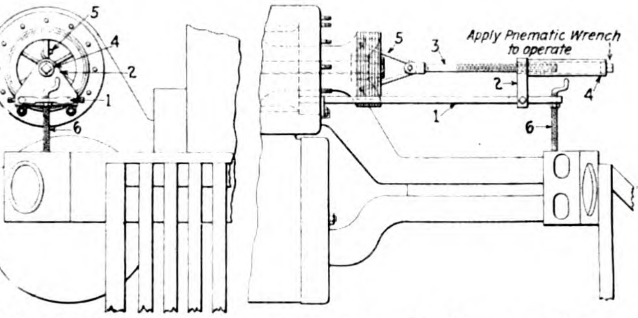
It consists of a rack or cradle, made of 1¼-in. round bar stock, which extends from the end of the front valve bushing to a point slightly beyond the back edge of the pilot beam and a threaded pulling rod, operated by a pneumatic wrench. The rack is so constructed as to form an elongated U, its width being equal to the horizontal spacing of the two bottom alternate studs of the valve chamber used for securing the front head to the chamber. Its length is governed by the distance between the cylinders and pilot beam of the locomotives on which it is to be used. The open end of the rack rests against the end of the front valve bushing in such a manner that the top of each leg is in line with the bore of the valve bushings proper, thus providing a convenient guide for the valve to slide on while either removing or replacing it, as well as a convenient place for resting the valve while inspecting it. The ends of the rack which set against the bushing are secured in alinement with the valve bushing by anchor lugs which engage the two bottom alternate studs on the front of the valve chamber. These lugs are welded to the rack after the cross member 2 has been slipped over the open ends of the rack.

The closed end of the rack is flattened horizontally to form a substantial seat for a 1-in. standard hexagon nut which is welded in position after a 1⅛-in. clearance hole has been drilled through the flattened portion of the rack. This nut engages with the spacing screw 6. This arrangement provides a quick vertical adjustment for maintaining the rack in a horizontal position on locomotives having various distances between the center line of the valve chamber and the top of the pilot beam, since the spacing screw 6 is the front support of the rack 1.

The cross-member 2, forged to the shape shown on the detail drawing, is 2 in. thick. Three holes are drilled in this piece as shown, the upper one through which the

1¼-in. pull rod passes being drilled 1 5/16 in. while the two lower holes are drilled 1-9/32 in. to provide a sliding fit on the 1¼-in. round legs of rack 1. The two lower holes are fitted with two ⅝ in. Standard set screws for securing the sliding member 2 in any desired location on the rack 1. The vertical distance between the upper and lower holes is governed by the distance between the center of rack 1 and valve chamber.

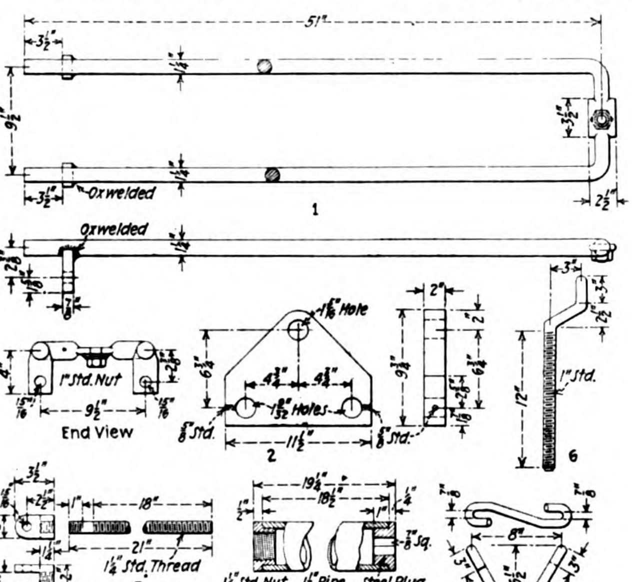
The pull rod 3, made of 1¼-in. round stock 21 in. in length, is fitted at one end with a clevis and hook 5 and at the other end with 18 in. of 1¼-in. standard thread to engage with the nut of the draw sleeve 4. The draw sleeve is 18 in. long and of 1½-in. double-strength pipe with outwardly beveled ends to form welding gaps



This piston-valve puller serves as a guide for removing and replacing the valve and forms a rack for inspecting it

for a 1¼-in standard nut and a steel plug, turned to a driving fit. The steel plug has a ⅞-in. square hole punched through it to engage the spud of a pneumatic wrench.

The hook 5 is used to couple the valve to the pull rod 3. It is made of 1-in. round steel, heated and bent to the shape shown, having a short hook on each leg bent outwardly in opposite directions. These short hooks



The details of the piston-valve puller

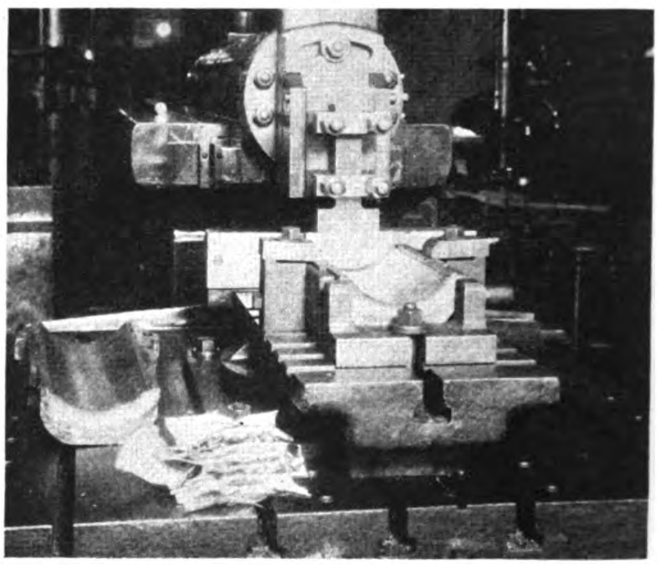
engage the two opposite spokes of the front follower or spider of the valve to be pulled, while the V-end engages with the ⅞-in. pin of the pull-rod clevis.

The spacing screw 6 is made of 1-in. round stock having about 12 in. of standard thread on one end while the other end is crank shaped so that it may be readily adjusted without a wrench. There will be found many cases of valve pulling where the use of the puller will not be necessary as the valves will yield to less pressure. In such cases, however, the use of the rack will be found to be of advantage as the cross-member 2 can be so adjusted to act as a fulcrum for a bar. The cross member can also be used when replacing the valve as it provides a short pinch for forcing the valve back into the bore, thus eliminating ramming the valve with a bar, a practice that is resorted to in some cases.

The rack 1 also forms a guide for the valve when replacing it in the valve chamber. The inspection facilities of this rack also permit the mechanic to turn the valve to any desired position without danger of having it roll off on the floor. Valve rings and bull rings are also exposed conveniently for calipering. In many cases of quarterly, semi-annually or annual inspections the valves will be found suitable for further service without attention but are not required to be replaced immediately. In such instances the rack is particularly convenient inasmuch as it affords a safe harbor for the valve until such time as is desired to replace it.

Broaching Tender Brasses

At the Silvis (Ill.) shops of the Chicago, Rock Island & Pacific, new engine truck and tender brasses are given an accurate and smooth surface bearing by broaching with a single stroke in the heavy-duty shaper, illustrated. Second-hand brasses are hammer-tested for looseness, examined for cracks, and, if not excessively worn, broached in the same manner. Relined, or rebabbitted brasses, also, are broached, one at a time, using the fixture shown, with a simple clamping arrangement and the flange of the brass fitting in a slot in the fixture to take the end thrust. A circular cutter made of carbon steel, hardened and ground to the proper size in a cylindrical grinding machine, is held in the tool holder of the clapper box. The brass-holding fixture is properly centered and three to five strokes taken, as necessary, to true up the surface. The result is a true, smooth surface, which fits the journal accurately, it is free from any possible inclusion of abrasive particles and, consequently, has a minimum tendency to run hot and cause locomotive delays.



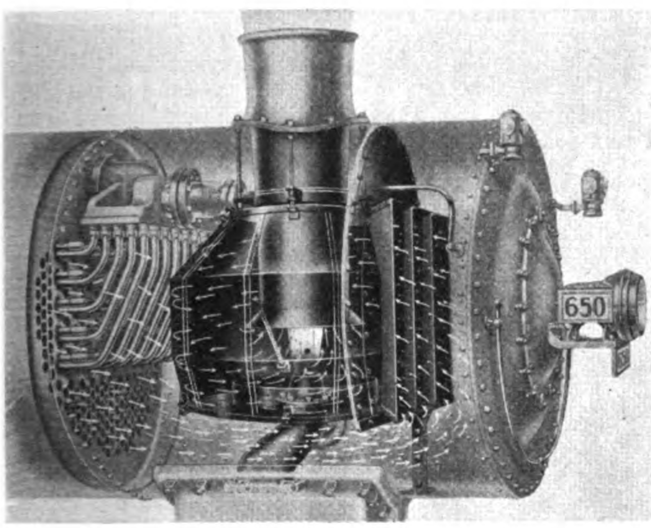
Holding fixture and cutter arrangement for broaching engine-truck and tender brasses at the Silvis shops

NEW DEVICES

Cyclone Spark Arrester

FOR a number of years, the Northern Pacific has been using Rosebud coal successfully on locomotives, this light lignite, secured from a large strip mine in eastern Montana, burning freely but being readily drawn to the smokebox and out of the stack. To find some means of burning this coal without attendant fire hazards, the Northern Pacific began experimenting, about two years ago, with a front-end device which depended upon centrifugal action rather than netting to prevent the emission of live sparks from the locomotive stack. This device was developed by M. F. Brown, general fuel supervisor of the Northern Pacific, and called the Cyclone spark arrester. It is now being manufactured by the Locomotive Firebox Company, Chicago, and is applied to about 300 locomotives on the Northern Pacific. A number of other roads are also making applications.

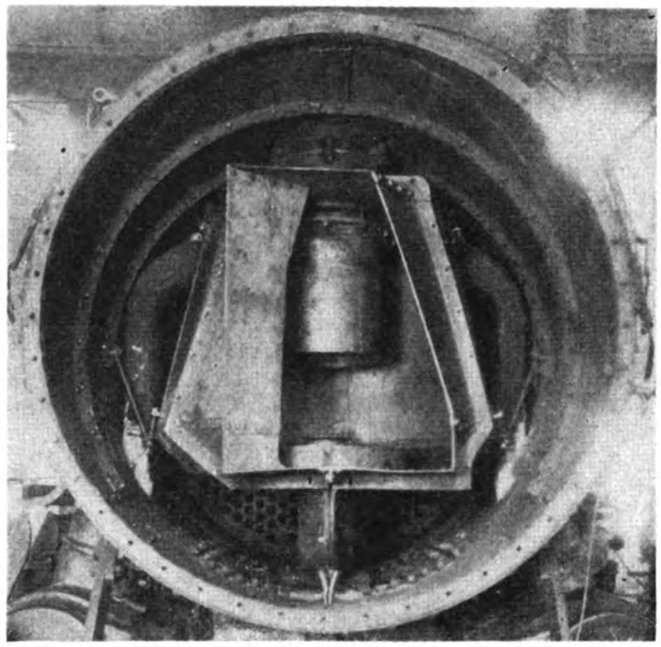
Extensive tests on the Northern Pacific, including two conducted by the Forestry Department of the United States Department of Agriculture, indicate that the new spark arrester prevents any sparks leaving the stack of sufficient size to start a fire on the right of way, even in hot summer weather and with low relative humidity. This seems to be equally true under any load



Phantom view showing the construction and operation of the cyclone spark arrester

and firing conditions from minimum to maximum. Besides functioning without front-end netting, a valuable feature of this spark arrester, as also shown by the tests, is that it can be used without paying any penalty in decreased efficiency due to higher cylinder back pressure. In fact, with this type of spark arrester, as compared to the standard Master Mechanic's front-end design, a slightly larger exhaust nozzle can generally be used. In addition to promoting the safe burning of light lignite as well as heavier coals on coal-burning locomotives, the new spark arrester is said to be equally adaptable to use on oil burners to prevent the emission of sparks produced from particles of firebrick and carbon deposits which become detached and overheated.

The Cyclone spark arrester consists of a large sheet metal drum which surrounds the smoke-stack extension and the nozzle tip, and carries at the sides and tops vertical baffle plates. The intake is also provided with deflectors so arranged that when a locomotive is working the gases and cinders enter the drum in a tan-



Cyclone spark arrester installation with one of the deflector vanes removed to show the interior arrangement

gential direction and continue in a circular movement throughout the drum. Centrifugal force carries the cinders to the wall of the drum where they are broken up by friction, ground to the size of coarse sand and extinguished in the gases which fill the drum. Gradually, the cinders work down to the bottom of the drum and, when small enough, are picked up and carried out of the stack in the usual manner.

Wire Netting Not Used

As indicated, wire netting, or perforated plate, is not used in connection with the Cyclone spark arrester, this being a fundamental divergence from the standard practice, as netting in one form or another is commonly depended upon to prevent the emission of sparks from locomotive stacks. Owing to the absence of netting, there is no possiblity of holes developing through which large sparks can pass and cause fires, nor is there any chance of clogged openings, with reduced effective air space and attendant possibility of steam and engine failures. The size of the drum in the new spark arrester is so related to the cross section of the flue area that there is no restriction of the draft of the locomotive.

The Cyclone spark arrester is designed with solid plates, made in sections, which can be removed to facilitate necessary repairs to flues or superheater units. Ease of inspection is an important feature, there being no necessity to look for small holes in a netting or around

(Continued on next left-hand page)

the plates, as in the standard Master Mechanic's front end. The cost of inspection, as well as maintenance, is, therefore, minimized.

Armite Arcweld and Hard-Surface Products

A GROUP of hard-facing products for application on friction surfaces have been developed by Armite Laboratories, 318 West Ninth street, Los Angeles, Calif. These are for application with the electric arc and by the oxy-acetylene process. The laboratory has developed several grades of inserts and compounds ranging in size from the smallest 20-mesh to ½-in. diameter for application to drilling bits, power-shovel teeth and for other services where inserts are desirable.

The company has also developed a product which is a tungsten-carbide compound that can be applied directly to any type of steel and by special application to manganese. The product, known as Armite Arcweld, is applied with an electric arc using a negative carbon electrode. The same material in tube form, known as Armite Autoweld, is also being introduced.

The laboratory, in addition to manufacturing materials of diamond-like hardness, has also developed a hard-facing rod of light weight for covering a large area per pound. This hard-facing rod is made in three grades of varying hardness.

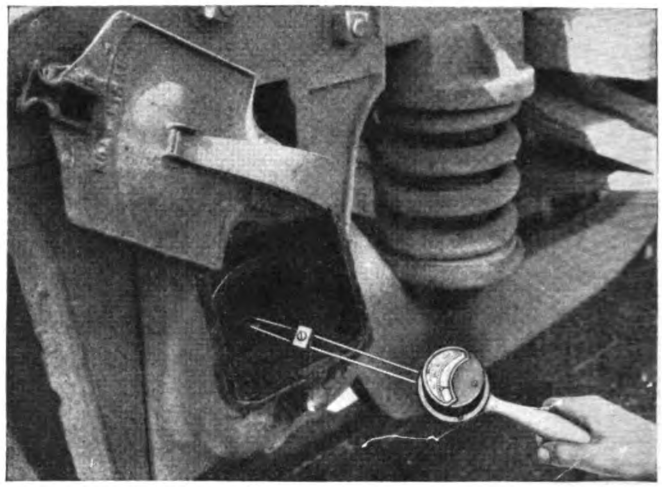
Hot Bearing Indicator*

A PORTABLE indicating pyrometer, recently developed and placed on the market by the Illinois Testing Laboratories, Inc., Chicago, is now being used in detecting hot bearings on locomotives and rolling stock, as well as for a number of other purposes in railway service.

This instrument, called the Pyro Prod, consists of a highly sensitive, yet rugged, millivoltmeter, to which is attached a pair of pointed thermo-couple wires. When the points of these wires are pressed against the bearing, the bearing metal completes the circuit and this causes a small flow of electric current to the indicator. This flow of current increases with the increase of temperature and causes the point of the millivoltmeter to deflect over a scale which is graduated in degrees Fahrenheit. Almost instant readings are obtainable, as it is merely necessary to make contacts between the pointed thermo-couple wires.

The Pyro Prod can be furnished in several different temperature ranges, but the one most generally used for bearing work is from 0 to 600 deg. F. When desired, the Pyro Prod is furnished with an automatic internal cold-end compensator. This is important where the instrument is to be used out-of-doors and subject to wide changes of atmospheric temperatures. Other models of contact-type pyrometers can also be furnished for measuring the surface temperature of other metals such as heated billets, rods and rails.

When used on locomotives, the Pyro Prod is carried in the cab and at each stop the engineman takes the instrument and goes from one bearing of the locomotive and tender to another, quickly checking the temperatures and eliminating all guesswork as to whether or not excessive temperatures are being developed, with consequent possibility of train delay. The instrument has also been used in connection with the heat treating



Convenient and accurate indicating pyrometer used to show the temperatures of a hot journal bearing

of rail ends after application to the track by heating with an oxyacetylene torch and subsequently quenching from the correct surface temperature as determined by the Pyro Prod.

* This device was described on page 662 of the November, 1930, issue of the *Railway Mechanical Engineer*.

Demountable Rim For Band Saws

THE Oliver Machinery Company, Grand Rapids, Mich., recently brought out a band-saw wheel designed as a steel-clad, five-ply laminated disc fitted with a demountable rim. The rim is made of aluminum,

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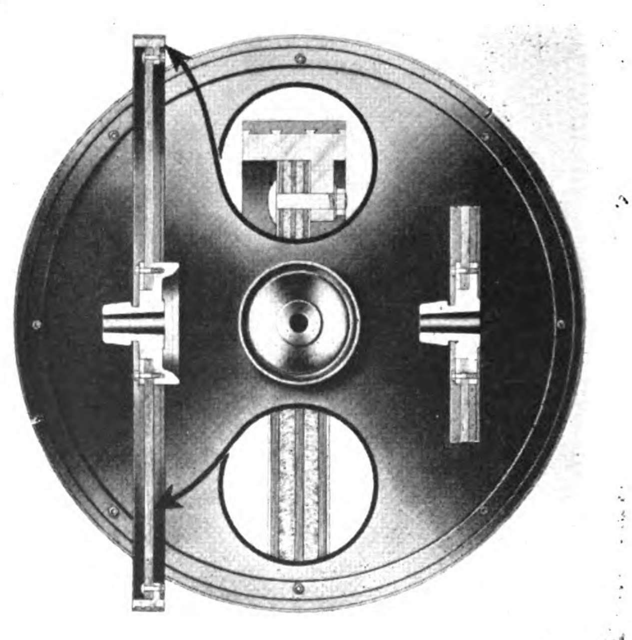


The Oliver demountable band-saw rim—The top insert shows the details of the rubber-faced tire and method of mounting the rim—The lower insert shows the construction of the laminated disc wheel

Don't build a Modern Locomotive from Obsolete Materials

AGATHON STEELS TRADE MARK

ONLY A few years ago, locomotive materials were confined to plain carbon steel, wrought and cast iron.

● But the modern locomotive, with its higher pressures, increased speeds and greater loads, now has a wide variety of alloy steels to draw upon, many of them developed by Republic metallurgists for the specific set of conditions they must meet.

● Today, higher boiler pressures have brought the Agathon steel boiler shell and the Agathon Alloy steel staybolt.

● Tubes are made of seamless, corrosion-resisting Toncan Iron; pins and bushings of Agathon Nickel Iron; still other special alloy steels go into rods, motion work and axles.

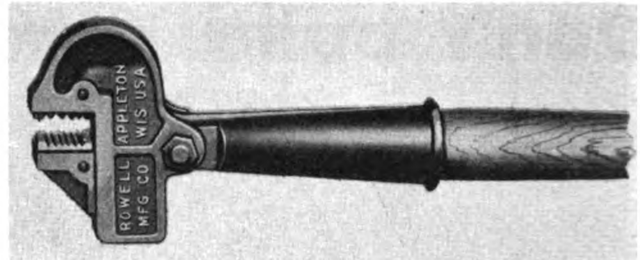
● Modern locomotives have their counterpart in modern materials. You wouldn't build a locomotive that is obsolete in design. Don't build one of obsolete materials. Consult with Republic metallurgists on the steels that best suit each condition of railroad service.

TONCAN COPPER Mo-lyb-den-um IRON

CENTRAL ALLOY DIVISION
REPUBLIC STEEL CORPORATION
Massillon, Ohio

a rubber tire being ground to a perfect circle and vulcanized into dovetailed grooves in the aluminum rim. The rubber used has a high zinc oxide content vulcanized on a hard rubber base which in turn is vulcanized into the grooves.

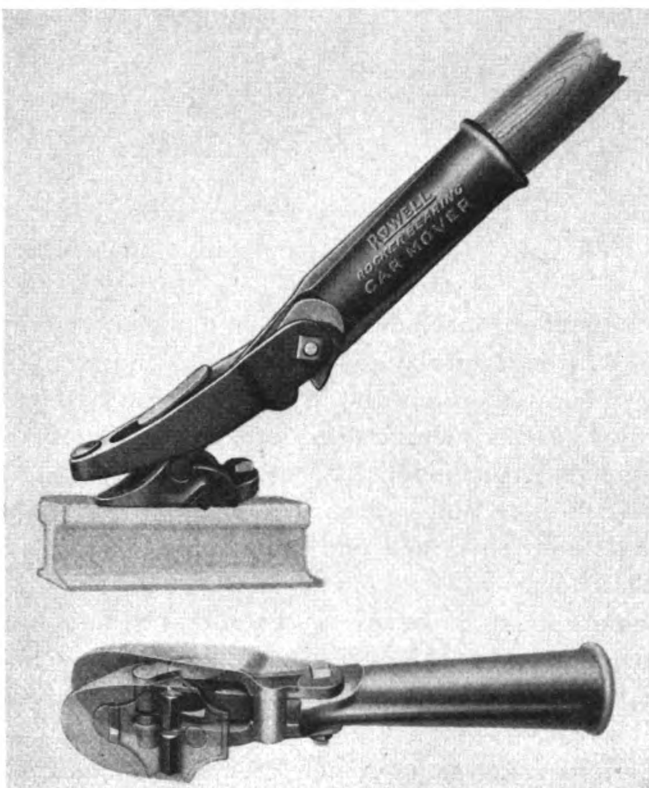
The demountable rim is designed for high-speed production and can be mounted on any 36-in. band saw. It was developed to eliminate the older method of stretching and cementing a rubber tire on the wheel and to reduce to a minimum the danger of breaking the rubber or not getting it to stick and the delays resulting from such practice.



The Rowell car wrench for opening drop- and hopper-bottom cars

Rowell Car Mover and Wrench For Hopper Bottom Cars

IN ONE of the illustrations is shown a car wrench made by the Rowell Manufacturing Company, Appleton, Wis. for opening drop or hopper bottom cars. It is designed with a swiveling head so that it can be operated at all angles with the hopper or releasing shaft, if



The Rowell car mover which develops a high rotating power at the car wheel

there are any obstructions on the car to prevent the wrench securing its grippage at right angles with the shaft.

The wrench is built from tested materials and is designed to withstand a handle load of 850 lb. before breakage of any part ensues. Its construction and leverage is such that the force applied to the handle is multiplied 27 times at the jaw. When using the wrench on drop or hopper-bottom cars, the jaws automatically close in on the shaft as soon as pressure is applied to the handle. The jaws are designed with teeth which insure the wrench from slipping as long as pressure or weight is applied on the handle. When the trip or pawl of the hopper doors is released, it is only necessary to remove the weight from the handle when the jaws will open and permit the tap or shaft to spin without endangering the operator.

The overall length of the wrench is 54 in. and its total weight is 18 lb. The jaws open to a maximum width of 2¾ in. and close to ¾ in.

The other illustration shows a rocker-bearing car mover which is designed to develop a high rotating power at the car wheel through co-ordination of the two principles of compound leverage and rocker-bearing movement. The rocker-bearing is constructed so that it works automatically in conjunction with the compound leverage. The car mover is fitted with two spurs which grip the rail when it is in a stationary position, this feature being used to eliminate slipping and to insure a positive grip on the rail. Each of the spurs has four sharp cutting edges so that when one edge becomes dull another is available. The spurs are made of high-carbon tool steel and are tempered and drawn. The handles are turned from selected rock maple wood.

Helical Cutter For Milling Side Rods

THE O. K. Tool Company, Inc., Shelton, Conn., has extended the application of the O. K. taper serrated cutter blades to include wide-face interlocking helical milling cutters.

The illustration shows a pair of such cutters milling

(Continued on next left-hand page)

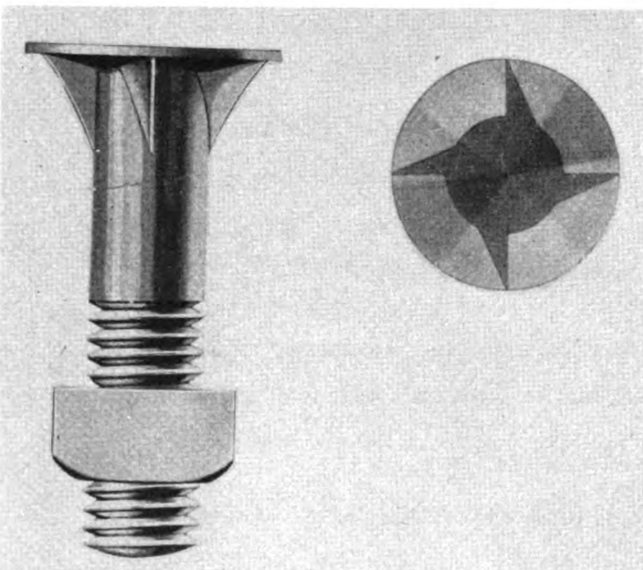
A pair of O. K. helical milling cutters milling the round ends of a pair of side rods

the round end of a side rod. The O. K. cutter blade is retained in the cutter body by its taper serrated shape, no other means being required to retain it in position. The serrations allow the blade to be moved outwardly for regrinding, a true helix being milled across the face of the cutter to give it a constant rake angle. The body is drop-forged of alloy steel. The cutters can be furnished singly or may be interlocked together to form slab milling cutters of any width.

The blade, which is tapered and has a serrated back, fits into a corresponding slot in the body. The tapered surface locks the blade securely in the body without the aid of any screws, taper pins or split body construction. The serrations permit the blade to be adjusted for wear. The blades, which are of drop-forged, high-speed steel, have a superior cutting edge, the forging operation refining the grain structure of the steel. The blade is hard and heat resisting while the body is tough and strong.

The Lewis Seal-Tite Bolt

THE Lewis Bolt & Nut Company, Minneapolis, Minn., recently placed on the market its Seal-Tite bolt which is designed with several features which make it adaptable wherever wood construction is a factor, especially for smooth lining and decking on box-car equipment. The bolt is equipped with four fins on a shank



The Lewis Seal-Tite bolt for smooth lining and decking of box car equipment

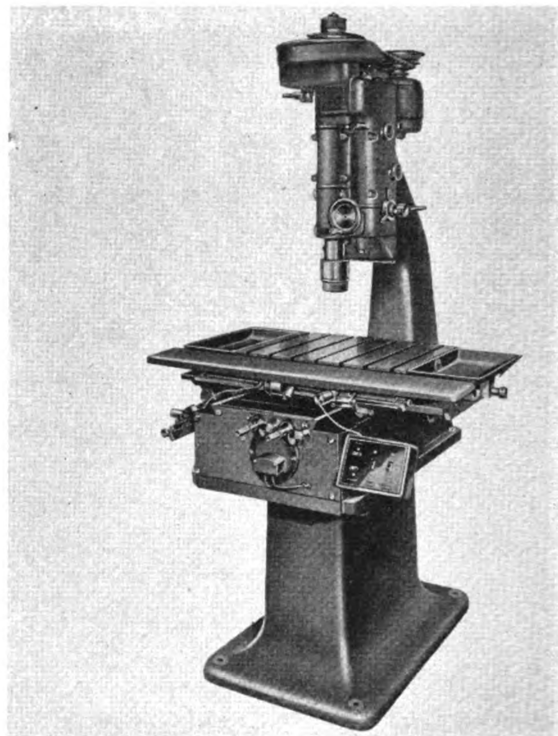
beneath the head which serve to hold the bolt from turning and which are so designed that the surface of the fin bearing against the wood in tightening is on a radial plane. The effect of this action is to produce the maximum holding power against turning and to eliminate the splitting action of a counter-sunk square-head bolt.

The tensile strength of the head has been found under test to be slightly higher than 50,000 lb. per sq. in., while being sufficiently thin to countersink flush with the surface of the wood. The head is designed so that the pressure of its tapered surface against the wood fibre will produce a water-tight connection. The bolts, which can be driven into the wood with an ordinary hammer, are available in sizes ranging from 1/4 in. to 3/4 in. in diameter, with lengths running from 1 in. to any size desired.

The Kellocater Jig Boring Machine

IN the illustration is shown a machine designed for fast precision jig boring and layout work. It was designed by the Keller Mechanical Engineering Corporation, 70 Washington street, Brooklyn, N. Y., to reduce dependence on human skill and to cut down chances of mechanical error. The only measuring devices on the machine are two vernier scales, one of which measures longitudinal movement while another measures transverse movement only.

Settings are made without moving the work or the table by lining up two sharply drawn graduations, one on the scale and the other on the vernier. Reading is



The Kellocater jig boring machine

done through a magnifying glass equipped with a built-in electric light. In connection with setting, an adjustable screw is provided so that the scale and vernier can be lined up to the nearest even inch. The machine is equipped with an automatic electric stop and a toggle switch which moves the work at a uniform speed by means of a magnetic clutch-driven lead screw. As the contact fastened to the table touches the anvil of the vernier slider, the magnetic clutch releases the lead screw and the table stops in location within an accuracy of .0002 in.

The machine is equipped with a recently developed lock which is designed to prevent slippage of the table over an oil film, thereby keeping the accuracy of the setting intact. The machine is designed so that it will bore one hole while setting up for the next, by using the automatic reversible spindle feed.

The machine is fitted with an extra-heavy spindle, made of chrome-nickel steel, which runs in ball bearings. Spindle speeds range from 77 r.p.m. to 1,750 r.p.m., four through open belt and four through back gears. It also has two reversible automatic feeds, .002 in. and .005 in., and a choice of hand-wheel and hand-lever feeds. An automatic depth-stop feed, with a scale

(Continued on next left-hand page)

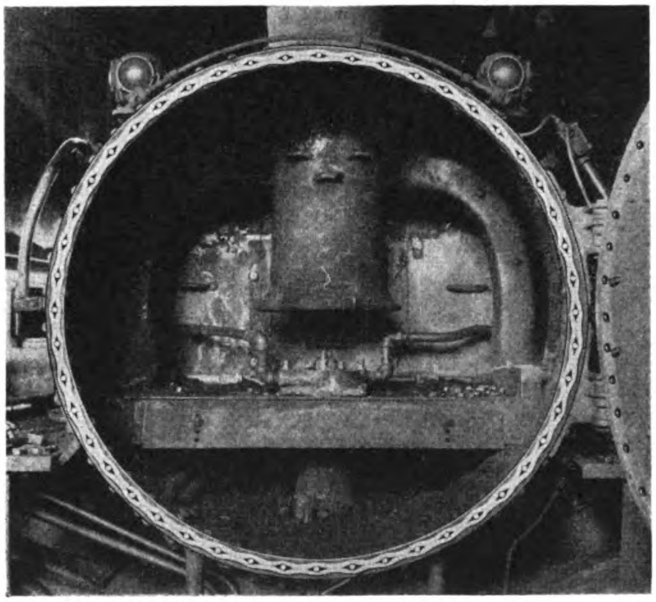
and a pointer, is attached to side of the spindle head.

The driving mechanism, including the magnetic clutch, is enclosed and protected in a box-shaped bed. The spindle motor is mounted on a hinged bracket adjustable for belt tensioning. The base and over-arm of the machine are of rigid design and the latter is gibbed and furnished with a crank for a vertical adjustment of 6 in.

Specifications of the machine include: Horizontal table travel, 18 in.; transverse table travel, 12 in.; table working surface, 14 in. by 21 in.; table top to spindle end, 2½ in. min. to 14½ in. max.; distance between spindle center and face of column, 14 in.; spindle motor, ½ hp.; vertical adjustment of spindle bracket, 6 in.; spindle-quill travel, 6 in.; weight, 1,375 lb.; dimensions, 55 in. by 45 in. by 78 in. high.

Garlock Button-Hole Asbestos Tape

THE Garlock Packing Company, Palmyra, N. Y., recently placed on the market an adaptation of asbestos tape for use on locomotive front ends and on flanged tanks of large diameters. The tape consists of parallel courses of Garlock folded asbestos wire-inserted cloth joined together by a single ply of bonding fabric.



The Garlock 616 button-hole tape applied to a locomotive front end

As shipped from the factory it contains no holes. The insertion of a knife blade between the parallel sections of the tape cuts the bonding fabric, forming a button hole which slips over the bolt or stud. The tape was designed so that a workman with no tools, other than a knife, can form a gasket which will remain in place, fit correctly, lay flat and form a seal around every bolt.

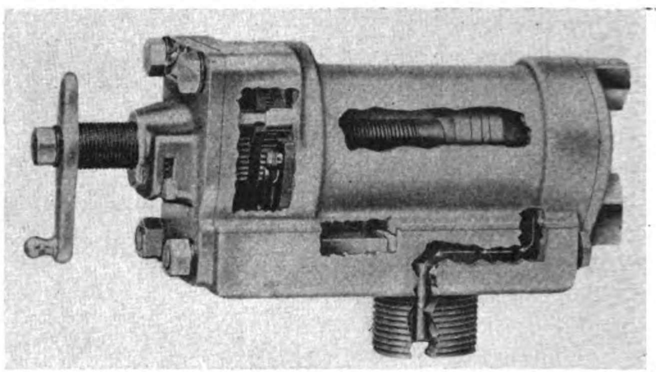
Ordinarily the button holes are cut as the tape is applied to avoid waste and possibility of errors in measurement. The tape is furnished printed with 1-in. graduation marks in case it is desirable to cut the holes at a work bench before applying it to a flange.

The tape, designated as the Garlock 616 Button-Hole Tape, is manufactured in coils of any desired length and in all regular widths and thicknesses. A typical application of the button-hole tape to the front end of the locomotive is shown in the illustration.

Automatic Inertia Crank Pin Lubricator

MULTI-SELECTO Phonograph Inc., Railroad Division, Grand Rapids, Mich., recently brought out what it designates as the Automatic Inertia lubricator which is designed to provide constant and positive lubrication for crank pins and valve motion pins.

The lubricator is installed by securing a threaded shank, cast integrally with the cylinder, into the rod directly above the pin and is locked against rotation by the use of a lock plate. The lubricator is 6½-in. long, 3¼ in. wide and 4 in. high and consists of a cylinder and an oblong metal box which contains a weight connected, through the medium of a bell crank, to a pawl carrier and pawl. The pawl engages a ratchet, which has an eccentric on one face. This eccentric is surrounded by a second pawl carrier upon which is pivoted a second pawl which engages a second ratchet threaded internally to conform to the threads on a feed screw. The screw



The automatic inertia lubricator for lubricating crank pins and valve motion pins

is fitted with a brass cup and piston of the same diameter as the inside of the cylinder and is slotted lengthwise to within ½ in. of its outer end. This slot prevents rotation of the feed screw until the lubricator is empty, through being engaged by a pawl or trigger pivoted to the cylinder casting. Upon reaching the end of this slot the pawl, or trigger, is automatically disengaged, thus allowing the feed screw to rotate and preventing damage to the lubricator through jamming.

The lubricator is operated by the rotation of the pin, or rod, causing the weight to slide longitudinally backward and forward in its chamber. The amount of this slide or travel is determined by the pitch of the teeth on the eccentric ratchet, this ratchet being connected to the weight by the bell crank and pawl. It follows that one revolution of the locomotive wheel is equal to one tooth on the eccentric ratchet and one revolution of the eccentric ratchet equals one tooth on the threaded or driving ratchet. The amount of grease fed to the pin can be controlled by either increasing or decreasing the number of teeth on the ratchet or the threads on the feed screw, or both, thus making it possible to apply the Automatic Inertia lubricator to any size pin. Recent tests run with the lubricator are said to have revealed the fact that when applied to a 72-in. wheel, it ran 850 miles per filling.

ONE HUNDRED YEARS AGO.—The South Carolina (now part of the Southern) on April 5, 1831, operated the first locomotive with a four-wheel engine truck. The locomotive hauled four cars with 117 passengers, 2.75 miles in 11 minutes.

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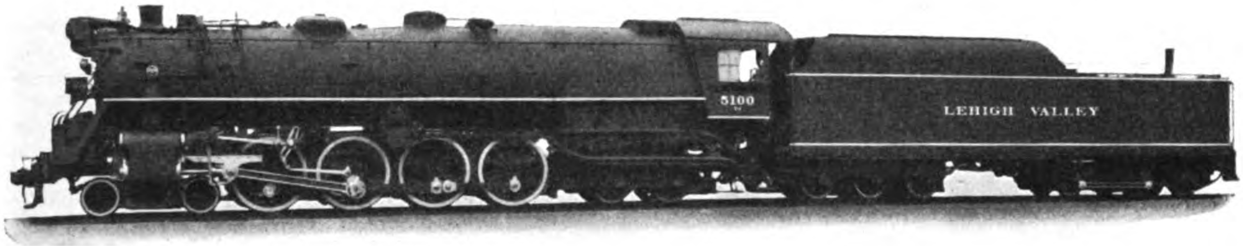
To Speed Up Freight Traffic On The Lehigh Valley



4-8-4 TYPE LOCOMOTIVE
Class T-1
LEHIGH VALLEY RAILROAD
J. P. LAUX
Superintendent Motive Power

Cylinders	27" x 30"
Drivers, diameter	70"
Steam pressure	250 lb.
Grate area	88 sq. ft.
Water heating surface	5422 sq. ft.
Superheating surface	2256 sq. ft.
Weight on drivers	270,000 lb.
Weight, total engine	408,000 lb.
Tractive force, main cylinders	66,400 lb.
Tractive force, with booster	84,760 lb.

THE LEHIGH VALLEY, while an important anthracite carrier, also handles a heavy tonnage of merchandise and perishable freight, which moves on fast schedules.

In accordance with a long-established policy of improving the service in every possible way, the road ordered from us a trial locomotive of the 4-8-4 type, which is now in service. This locomotive is specially designed to handle on a fast schedule, a load of 3000 tons from Buffalo to tide-water, with the assistance of a helper on the Mountain Cut-off near Wilkes-Barre, where the grade is 60 feet per mile.

Lehigh Valley engine 5100 is typical of the strictly modern fast freight hauler — with large drivers, high steaming capacity, and a design that insures maximum output in ton-miles per hour, with a minimum charge for fuel, supplies and maintenance.

THE BALDWIN LOCOMOTIVE WORKS 1831 1931

THE BALDWIN LOCOMOTIVE WORKS

PHILADELPHIA

Among the Clubs and Associations

NEW ENGLAND RAILROAD CLUB.—The annual banquet and entertainment of the New England Railroad Club will be held in the ball room of the Copley-Plaza Hotel, Boston, Mass., at 6:30 p.m., daylight saving time.

WESTERN RAILWAY CLUB.—The election of officers and directors and the annual dinner and entertainment of the Western Railway Club will take place on May 22 at the Hotel Sherman, Chicago. The dinner will be at 6:30 p.m. and at 8 p.m. the Reverend Ernest S. Tittle of the First Methodist Church, Evanston, Ill., will speak on Creative Life.

CAR FOREMEN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—The cleaning of passenger car equipment will be the subject discussed by H. E. Moran, general car foreman of the Chicago Great Western before the meeting of the Car Foremen's Association of Omaha, Council Bluffs and South Omaha Interchange to be held at Council Bluffs, Iowa, at 2 p.m. on May 14. The election of officers will also take place at this meeting.

TORONTO RAILWAY CLUB.—The Toronto Railway Club, organized at Toronto, Ontario on March 13, has already enrolled 869 members. Meetings are to be held on the third Monday of each month, excepting June, July and August. The officers of the club are: President, T. C. Hudson, general superintendent, Canadian National; first vice-president, R. McKillop, superintendent, Canadian Pacific; second vice-president, H. T. Malcolmson, vice-president, Toronto, Hamilton & Buffalo; treasurer, G. H. Davis, assistant district engineer, Canadian Pacific; secretary, J. A. Murphy, assistant to the general superintendent of the Canadian National, Toronto.

FIFTH OIL POWER CONFERENCE.—The fifth oil power conference, under the joint auspices of the Pennsylvania State College and Lubrication Engineering Committee of the Petroleum Division, American Society of Mechanical Engineers, will be held on Friday, May 22, at the Pennsylvania State College, State College, Pa. R. L. Sackett, dean of engineering at State College, will preside at the morning session, at which E. G. Boden, engineer, and O. L. Maag, oil chemist, of the Timken Roller Bearing Company, will discuss lubricant testing. L. J. Bradford, professor of machine design at State College, will present a paper on Bearing Design in the Light of Oil Film Pressure Investigations, and F. O. Willhofft, secretary and general manager of the Isothermos Corporation of America, will present a paper on Fluid Film Lubrication as Applied to Railroad Journal Bearings. There will also be an Oral Discussion of Lubrication of Railway Bearings, by M. E. McDonnell, chief chemist, Pennsylvania Railroad. At the afternoon session there will be a Symposium on Internal-Combustion Engine Lubrication with Lubricants from Coastal Crudes, Pennsylvania Crudes, and Midcontinent Crudes, the session being presided over by J. G. O'Neill, chief chemist, U. S. Naval Engineering Experiment Station, Annapolis, Md.

Club Papers

Chilled Car Wheels

New York Railroad Club.—Meeting held at the Engineering Auditorium, 29 West 39 street, New York City. Paper by G. E. Doke, president of the Association of Manufacturers of Chilled Car Wheels. ¶In his address, which was illustrated by slides, Mr. Doke showed the location of the 58 factories in the United States and Canada which are producers of chilled car wheels. He discussed the history of the development of the chilled car wheel and the manufacturing methods used today. Mr. Doke's paper was followed by a motion picture which showed the successive steps in the manufacture of chilled car wheels.

The Foreman's Relation to His Men

Toledo Car Inspection Association.—Meeting held at Hotel Secor, April 14, 1931. Papers by W. Laub, Pennsylvania shop foreman, and by G. E. Doke, president of the Association of Manufacturers of Chilled Car Wheels. ¶Mr. Laub discussed in his paper the forman's relations to his men and related the change which has taken place in the requirements for the position of foreman. Formerly, he stated, it was the man with strong physique who could, by his strength and persuasiveness, control the action and energies of his men. Today, however, the forman's greatest objective is to secure co-operation, Mr. Laub stated, rather than to force output by any physical characteristics. ¶Mr. Doke's paper, illustrated by slides, discussed the history and the present day methods of manufacturing chilled car wheels. It was followed by a motion picture showing the various steps in the manufacture of the wheels. ¶A complete entertainment program was furnished by the Wine Railway Appliance Company of Toledo.

The Coffin Feedwater Heater System

The Southern and Southwestern Railroad Club.—Meeting held March 19 at Atlanta, Ga. Paper by C. W. Wheeler, The J. S. Coffin, Jr., Company, Englewood, N. J., on the subject, "The Coffin Feedwater Heater System and Its Relation to Feedwater Heating." ¶ Mr. Wheeler's paper gave a complete description of the Coffin Feedwater heater system consisting of a main closed type heater, an auxiliary open type heater, a centrifugal type boiler feed pump, a control valve and miscellaneous fittings and connections. ¶ In his paper Mr. Wheeler stated that "In a recent Frisco endurance test run of thirty-one days duration, no work of any description was performed on the Coffin system. The system operated perfectly and temperatures averaging 210 deg. F. were obtained for the entire run of 9,700 miles. As this test was conducted in one of the recognized bad-water districts of the United States, it proves the practical adaptability of operating the closed heater unit of the Coffin Feedwater heater system in bad water districts." ¶The paper was accompanied by slides which showed various applications of the Coffin feedwater heater, and views of the individual units of the system and diagrammatic sketches of them.

Car Men Discuss Supplies

Car Foremen's Association of Chicago.—Meeting held April 13 at Chicago. Address by J. G. Stuart, general storekeeper, Chicago, Burlington & Quincy, on the problem and importance of securing co-ordination between the car and store forces in meeting the requirements for material and reducing maintenance equipment. ¶ Mr. Stuart emphasized the fact that both departments have a joint responsibility to work harmoniously. ¶ The two departments must co-ordinate their efforts, he advanced, and the development of a feeling of mutual respect is essential to the purpose. When this respect is lacking, he contended, there can be little or no co-operation. In the interest of conserving material, Mr. Stuart pointed out that car department foremen must realize that a dollar spent for material is as large as a dollar spent for labor, and he developed the thought that a foreman who is willing to help the storekeeper is correspondingly helping himself and the progress of his work. ¶ He advocated assigning to stores forces the work of delivering all car material, adding that this procedure would save the time of car forces as well as material. "There are still some car foremen who do not know as much now as the ordinary bricklayer knew 50 years ago," said Mr. Stuart

(after explaining how the bricklayer confines his attention to laying brick and depends upon the hodcarrier to provide the material), "but when they do learn, they will not only want material delivery but they will demand it." ¶ Over 300 car supervisors attended the meeting.

Manhattan Air Brake Club

Manhattan Air Brake Club.—Meeting held in Room 2300, 150 Broadway, New York, February 20, 1931. ¶The following subjects were discussed at the February meeting of the Manhattan Air Brake Club: Gaskets—Is it a general practice to recondition used gaskets? What success is had with reconditioning and what methods are used? Are used gaskets replaced without reconditioning? How is it determined when a gasket should be scrapped? Quadruplex air gages; trailer and truck brakes on steam locomotives; Electro-Tite hose fittings; piston valve bushings for 8½-in. cross-compound compressors, and permissible variation in the length of the regulating valve in the M-3 feed valve. ¶A few of the roads represented at the meeting recondition used gaskets, but the majority have found it more practical and economical to use new gaskets due to the fact that gaskets once removed were so worn as to be unfit for service. Most of the roads represented at the meeting rebore piston-valve bushings and use over-size pistons and rings. In a few instances the bushings are renewed. ¶The manufacturers fit the M-3 feed valve up to the regulating valve just touching the diaphragm when the diaphragm is in its normal position on the seat with no spring pressure behind it. The valve will operate satisfactorily with the regulating valve clearing the diaphragm by 1/64 in. in this position, or with the regulating valve depressing the diaphragm approximately .008 in. in this position. Further variation than this will cause erratic operation of the feed valve. Meeting held at 150 Broadway, New York City, March 20, 1931. ¶The March meeting of the Manhattan Air Brake Club was devoted to a discussion of renewing piston-valve bushings for 8½-in. cross-compounded air compressors, which subject was carried over from the February meeting; cleaning of main reservoirs, pneuphonic horns and modified reversing valves for 9½-in. steam driven air compressor. The April meeting was featured by a talk on the Siskiyou air brake tests by G. E. Terwilliger, Superintendent of Auxiliary Equipment, New York, New Haven & Hartford.

Twenty-Five Years Ago.—The first gasoline electric car to be used on the Vanderbilt lines has been completed by the manufacturer for the Lake Shore & Michigan Southern [now part of the New York Central]. The car is operated by a 220-hp. gasoline engine in connection with an electric generator and is designed for a speed of 65 miles per hour. The Missouri Pacific has under construction a steam-motor car for passenger service which is designed to accommodate 64 passengers.—Railway Age, April 6, 1906.

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

Air-Brake Association.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

American Railway Association.—Division V. —Mechanical.—V. R. Hawthorne, 59 East Van Buren street, Chicago. Meeting June 23, 24 and 25, Congress Hotel, Chicago.
Division V.—Equipment Painting Section.—V. R. Hawthorne, Chicago.
Division VI.—Purchases and Stores.—W. J. Farrell, 30 Vesey street, New York. Next meeting May 19, 20, 21, Biltmore hotel, Atlanta, Ga.
Division I. — Safety Section. — J. C. Caviston, 30 Vesey street, New York.
Division VIII.—Car Service Division.—C. A. Buch, Seventeenth and H streets, Washington, D. C.

American Railway Tool Foremen's Association.—G. G. Macina, 11402 Calumet avenue, Chicago.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.
Railroad Division.—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York.
Machine Shop Practice Division. — Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.
Materials Handling Division.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.
Oil and Gas Power Division.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.
Fuels Division.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

American Society for Steel Treating.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

American Society for Testing Materials.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa.

American Welding Society.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

Association of Railway Electrical Engineers.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

Association of Railway Supply Men.—J. W. Fogg, MacLean-Fogg Lock Nut Company, 2649 N. Kildar avenue, Chicago. Meets with International Railway General Foremen's Association.

Boiler Maker's Supply Men's Association.—Frank C. Hasse, Oxweld Railroad Service Company, 230 N. Michigan avenue, Chicago. Meets with Master Boiler Makers' Assoc.

Canadian Railway Club.—C. R. Crook, 2276 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month except in June, July and August, at Windsor Hotel, Montreal, Que.

Car Department Officers Association.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

Car Foremen's Association of Chicago.—G. K. Oliver, 2514 West Fifty-Fifth street, Chicago. Regular meeting, second Monday in each month except June, July and August, Great Northern Hotel, Chicago, Ill.

Car Foremen's Club of Los Angeles.—J. W. Krause, 608 South Main street, Los Angeles, Cal. Meetings second Monday of each month except July, August and September, in the Pacific Electric Club building, Los Angeles, Cal.

Car Foreman's Association of Omaha, Council Bluffs and South Omaha Interchange.—Geo. Kriegler, car foreman, Chicago, Burlington & Quincy, Sixteenth avenue and Sixth streets, Council Bluffs, Iowa. Regular meetings, second Thursday of each month at Council Bluffs.

Car Foremen's Association of St. Louis.—F. G. Weigman, 720 North Twenty-third street, East St. Louis, Ill. Regular meeting first Tuesday in each month, except July and August, at American Hotel Annex, St. Louis, Mo.

Central Railway Club of Buffalo.—T. J. O'Donnell, executive secretary, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meeting, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

Cincinnati Railway Club.—D. R. Boyd, 453 East Sixth street, Cincinnati. Regular meeting second Tuesday, February, May, September and November.

Cleveland Railway Club.—F. L. Frericks, 14416 Adler avenue, Cleveland, Ohio. Meeting second Monday each month, except July, August and September, at the Auditorium, Brotherhood of Railroad Trainmen's building, West Ninth and Superior avenue, Cleveland.

Eastern Car Foremen's Association.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings fourth Friday of each month, except June, July, August and September.

Indianapolis Car Inspection Association.—E. A. Jackson, Box 22, Mail Room, Union Station, Indianapolis, Ind. Regular meetings first Monday of each month at Hotel Severin, Indianapolis, at 7 p.m. Noon-day luncheon 12:15 p.m. for Executive Committee and men interested in the car department.

International Railroad Master Blacksmith's Association.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

International Railroad Master Blacksmith's Supply Men's Association.—J. H. Jones, Crucible Steel Company, of America, 650 Washington boulevard, Chicago.

International Railway Fuel Association.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago.

International Railway General Foremen's Association.—William Hall, 1061 W. Wabash street, Winona, Minn.

International Railway Supply Men's Association.—W. J. Dickinson, acting secretary, 1703 Fisher building, Chicago. Meets with International Railway Fuel Association.

Louisiana Car Department Association.—L. Brownlee, 3730 South Prieur street, New Orleans, La. Meetings third Thursday.

Master Boilermaker's Association. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

Master Car Builders' and Supervisors' Association.—See Car Department Officers Association.

National Safety Council.—Steam Railroad Section.—W. A. Booth, Canadian National Montreal, Que. William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

New England Railroad Club.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting, second Tuesday in each month, excepting June, July, August and September. Copley-Plaza Hotel, Boston.

New York Railroad Club.—Douglas I. McKay, executive secretary, 26 Cortlandt street, New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York.

Pacific Railway Club.—W. S. Wollner, P. O. Box, 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

Pueblo Car Men's Association.—I. F. Wharton, chief clerk, Interchange Bureau, Pueblo, Colo.

Railway Business Association. — Frank W. Noxon, 1124 Woodward building, Washington, D. C.

Railway Car Men's Club of Peoria and Pekin.—C. L. Roberts, chief clerk, Peoria & Pekin Union Railway, 217 Lydia avenue, Peoria, Ill.

Railway Club of Greenville.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meetings third Tuesday of each month, except June, July and August.

Railway Club of Pittsburgh.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Regular Meeting fourth Thursday in month, except June, July and August. Ft. Pitt Hotel, Pittsburgh, Pa.

Railway Equipment Manufacturers' Association.—F. W. Venton, Crane Company, 836 South Michigan avenue, Chicago. Meets with Traveling Engineers' Association.

Railway Fire Protection Association.—R. R. Hackett, Baltimore & Ohio, Baltimore, Md.

Railway Supply Manufacturers' Association.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

St. Louis Railway Club.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

Southern and Southwestern Railway Club.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, June, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

Supply Men's Association. — E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division American Railway Association.

Supply Men's Association.—Bradley S. Johnson, W. H. Miner, Inc., Chicago. Meets with Car Department Officers Association.

Toronto Railway Club.—J. A. Murphy, 1405 Canadian National Express building, Toronto 2, Ont. Meetings Third Monday of each month, except June, July and August.

Traveling Engineers' Association. — W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio.

Western Railway Club.—W. I. Dickinson, 343 South Dearborn street, Chicago. Regular meetings, third Monday in each month.

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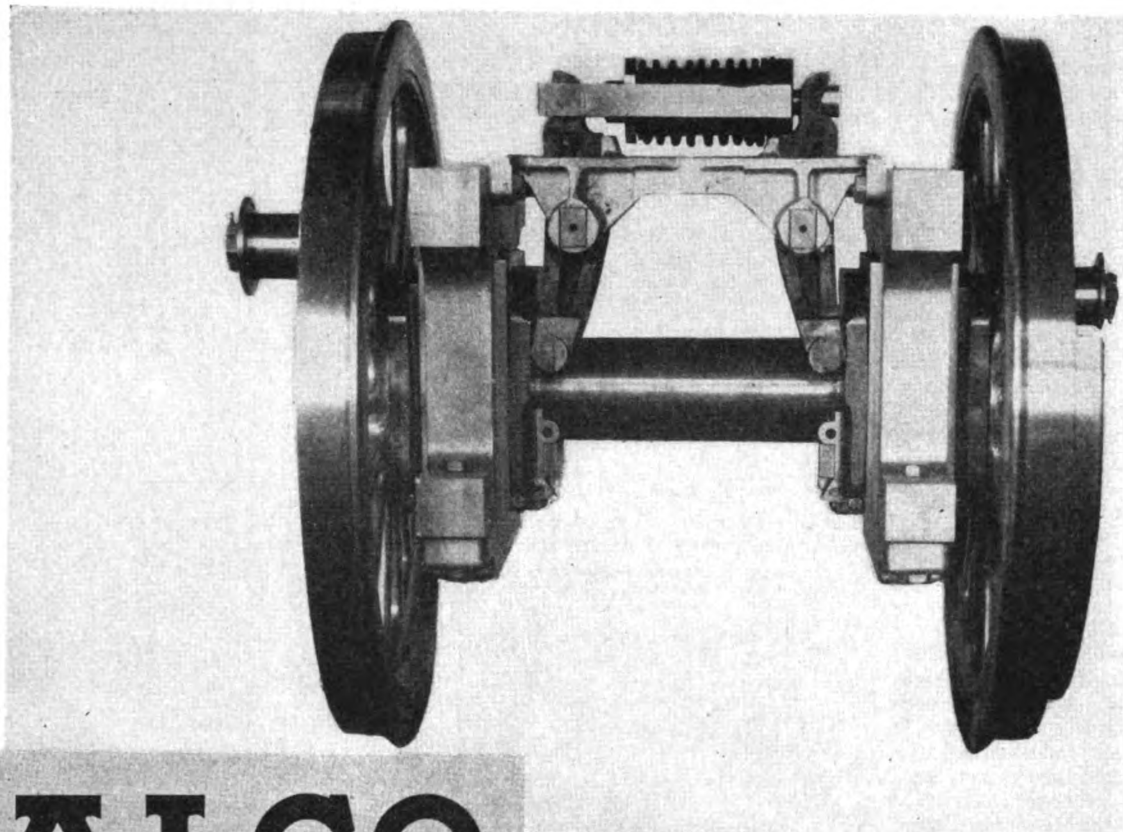

NEWS

Consulting Service on Steel Castings

WITH THE establishment of an engineering department, under the direction of an experienced metallurgist and engineer, the Steel Founders' Society of America is now offering without charge or obligation, a consulting service to mechanical engineers, designers and others engaged in the selection and application of metals and responsible for their proper use in metal products of all kinds. In this service the society offers assistance with such problems as the proper apportioning of metal sections for best casting results; advice as to the types of cast steels which are available to satisfy desired physical specifications; redesign of cast steel members with which trouble has been experienced either in production or service; assistance in locating a foundry capable of handling individual requirements; authoritative information on the relative merits of cast steel as compared with other materials in meeting specific service conditions; consulting on engineering problems involved in the construction of machinery and equipment of all kinds where cast steel is being considered, and informal discussions with small groups of designers and others interested to help them obtain a better working knowledge of the products of the steel foundry.

Problems in metal construction on which help is desired should be addressed to the Development Engineering Department, Steel Founders' Society of America, Inc., 420 Lexington avenue, New York.

Large Locomotive Tender

ONE OF THE largest tenders ever used with a locomotive in passenger train service on any railroad is now being tested on the Pennsylvania. It is 55 ft. 5¼ in. long and 14 ft. 11½ in. high, from the rail to its highest point, with a water capacity of 25,000 gal., a coal capacity of 25 tons (as much as carried by a regular hopper car in the coal trade 50 years ago), and weighs 142,180 lb. empty and 395,800 lb. loaded to capacity. The K4s locomotive and tender combined measure 104 ft. 9½ in. from coupler to coupler. A comparison of the Pennsylvania's first tender, which served the John Bull locomotive, with the modern 25,000-gal. tank is illuminating. The primitive tender was a sheet iron cylinder 6 ft. in diameter, 6 ft. high, standing in a small flat car. It held 1,150 gal. of water. The diminutive tender weighed 19,600 lb., one-twentieth the weight of the latest model.

A K4s locomotive, with its huge tender, has been assigned to the Pennsylvania's Eastern region for test purposes.

Erie to Move Executive Offices

PENDING PROPOSALS for the removal of the executive offices of the Erie from New York to Cleveland, Ohio, in order to bring these offices nearer the geographical center of the railroad, were considered and approved at a recent meeting of the board of directors. The move, which will take place late in the summer, will include the traffic, operating, engineering, mechanical, claims and accounting departments, although an executive office and a complete traffic organization (both passenger and freight) will be maintained in New York.

Progress Reported on Four-System Plan

COUNSEL for the Baltimore & Ohio, the Chesapeake & Ohio, the New York Central and the Pennsylvania are still working on the details of the petition they expect to present soon to the Interstate Commerce Commission for such modification of its consolidation plan as may be required to pave the way for consideration of the plan for grouping the eastern railroads into four great systems. No definite predictions are available, however, as to how much time will yet be required before the petition can be filed.

One step toward the adjustment of one of the important unsettled features of the plan has been taken, it was learned following a meeting of counsel in Washington on March 25, by the appointment of George T. Slade, formerly vice-president of the Northern Pacific and now a director of several railroads, as arbitrator of the question as to the right to the use of the Pennsylvania of trackage over the Nickel Plate between Ashtabula, Ohio, and Brocton, N. Y.

Other points still unsettled involve the price to be paid by the Chesapeake & Ohio-Nickel Plate group for stock of the Lehigh Valley, held by Pennsylvania interests; and the disposition of the Virginian. Executives of the four systems held a conference in New York on March 26 with representatives of the railway labor organizations in an effort to reach some understanding as to principles for the protection of the interests of the employees as they may be affected by unifications.

Milwaukee Receives Second Locomotor

THE CHICAGO, MILWAUKEE, ST. PAUL & PACIFIC has received its second Locomotor, a rail motor coach equipped with a high-pressure, condensing steam power plant, and an initial run was made on April 7, from Chicago to Elgin, Ill., and return. On this run, the car, which was built by the Ryan Car Company, with the power plant furnished by the International Harvester Company, hauled one trailer, and the train was subjected to various operating conditions and rates of speed. The new car is 61 ft. long and weighs 127,000 lb. It is driven by two 8-cylinder unaflow steam engines, capable of developing 225 h.p. each, or a total of 450 h.p. Steam is used at 700 lb. pressure. After the trial run, the car was sent to Cedar Rapids, Iowa, where it was placed in service between Cedar Rapids and Ottumwa.

Hot Boxes Not So Frequent

THE CHESAPEAKE & OHIO in the year 1930 had only one hot box for 305,481 car-miles and this record, given in the Chesapeake & Ohio Magazine for April, is compared with less successful records back to 1923, when the average was one hot box to each 33,000 miles. This record is credited to the complete co-operation of all individuals and departments having duties connected with this service. Mr. Moler, supervisor of lubrication, says that with proper effort and co-operation, the average can be made one to a million car-miles.

Mr. Moler estimates that each hot box costs at least $20, perhaps $30; and, making the estimate at the lower figure, he calculates that the cost of hot journals on his road for 1924 was $299.480; in 1925,

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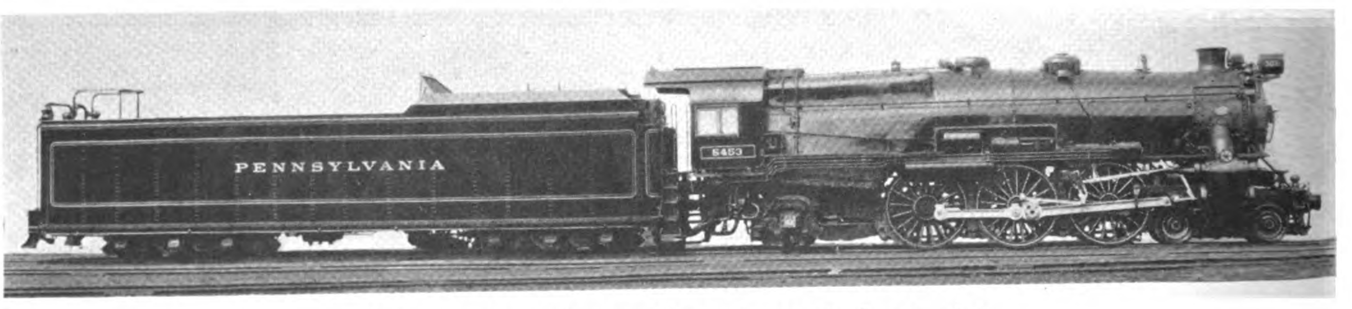

A 25,000-Gal. Tender for a Pennsylvania K4s Locomotive

$198,260; and so on down to 1930 when the total of cases was 3,564, and the cost was $71,280. The total of these expenses since 1924, on this basis of calculation, is nearly $1,000,000.

For the past eight years, the company's brass foundry at Huntington, W. Va., has made about 216,388 journal brasses yearly, 20 men being employed in the work; but on January 11, last, the foundry was closed for lack of orders and moreover no orders for brasses have been given this year to outside markets. Before this, for at least 30 years, this foundry had made journal bearings each and every day.

DeVilbiss Training School

THE RAPIDLY INCREASING use of the spray method of applying paints, varnishes, lacquers and other protective coatings has resulted in the establishment of a training school for this particular branch of industrial processing by the DeVilbiss Company, Toledo, Ohio. This school, designed to instruct DeVilbiss users in the care, operation and use of spray painting and spray finishing equipment, as well as in the accepted methods of securing all desired results, is open to owners, users, or distributors of DeVilbiss equipment. There is no cost connected with it other than transportation and living expenses.

The student desiring to take this course should first make application to the DeVilbiss Company. Upon approval, he will be assigned a definite date of entrance. While the minimum length of the course is three days, the company prefers that students remain one week, during which period each student is given individual and thorough instruction and practice in all phases of spray painting and spray finishing.

The first part of the course covers the mechanical features of spray painting and finishing equipment. The student is next taught to operate and service the equipment, finally specializing in actual spray painting, spray finishing, decorating or refinishing work.

Prof. A. J. Wood Dies

ARTHUR J. WOOD, head of the department of mechanical engineering at Pennsylvania State College, State College, Pa., died on Saturday, April 18, after having been struck by a motorcycle. Professor Wood was born at Newark, N. J., on September 3, 1874. He attended high school at Boonton, N. J., his education being continued at Stevens School (1892); Stevens Institute of Technology (M. E. 1896); Columbia University Graduate School (1898), and Pennsylvania State College (M. S. 1916). From 1896 to 1900 Professor Wood was on the staff of the Railroad Gazette, now the Railway Age. He was instructor of mechanical engineering at Worcester Polytechnic Institute from 1900 to 1902 and professor of mechanical engineering at Delaware College from 1902 to 1904. He went to Pennsylvania State College as assistant and associate professor of experimental engineering in 1904 and from 1910 to 1921 was associate professor and professor, railroad mechanical engineering, becoming head of the department during the latter year. Professor Wood was also consulting engineer

A. J. Wood

for railroads and engineering companies. He was the author of Principles of Locomotive Operation; Pre-determination of Locomotive Performance; Investigation of Railroad Car Radiators; Researches in Heat Transmission; The Economical Thickness of Insulation in Refrigerator Cars, and numerous articles and papers on the design of insulation for refrigerator cars and methods of testing heat transmission. He was a member of the American Society of Mechanical Engineers and the American Institute of Refrigeration and a past president of the American Society of Refrigerating Engineers.

P. & S. Contest Winners

THE FOURTH annual contest conducted by the Purchases and Stores division of the American Railway Association for papers by junior officers and members of railway purchases and stores departments on subjects relating to the work of those departments resulted in the awarding of the honors to Emmet J. Dennedy, stock clerk in the office of the division storekeeper of the Baltimore & Ohio at Ivorydale, Ohio, and William Courage, trucker at the general stores of the Canadian National at Fort Rouge, Winnipeg, for having written the two best papers. Mr. Dennedy's paper was entitled "Mechanical Power," and that of Mr. Courage, "Can Future Requirements Be Anticipated More Accurately?" The two papers share the honors equally and their authors will be rewarded by a trip to the annual convention to be held in Atlanta, Ga., where they will present their papers.

Bucyrus Shops Litigation

THE CITY OF BUCYRUS (Ohio) has been granted a temporary injunction enjoining the New York Central from removing its shops in that city to Collinwood, Ohio, near Cleveland. The city contends that it gave the railroad the ground on which its shop buildings now stand with the stipulation that buildings and equipment would revert to the city if the railroad should ever abandon them. Evidence produced at the court hearing showed that in 1880 the Ohio legislature enacted a statute giving a city the right to enter into such a contract with any railroad or industrial concern.

(Continued on next left-hand page)

Domestic Orders Reported During April, 1931

Locomotives

Name of Company	Number ordered	Type	Builder
Bush Terminal Company	7	Oil-Electric	Ingersoll-Rand
Total for month	7		

Freight Cars

Name of Company	Number ordered	Type	Builder
Delaware, Lackawanna & Western	25	Dump	Magor Car Corp.
	10	Dump	Koppel Industrial Car & Equipment Co.
Minneapolis & St. Louis	100	Flat	General American Car Co.
Sheffield Farms Company	12	Tank	General American Pfaudler Corp.
Delaware & Hudson	100	Box	Company Shops
Great Northern	500	Hopper	Standard Steel Car Corp.
General Chemical Company	15	Tank	American Car & Fdry. Co.
Northern Pacific	500	Box	Company Shops at Brainerd, Minn.
	500	Stock	Como Shop, St. Paul, Minn
	500	Box	Company Shops at Laurel, Mont.
	500	Box	Company Shops at Brainerd, Minn.
Thunder Bay Quarries Co.	6	Dump	Koppel Industrial Car & Equipment Co.
Union Tank Car Co.	15	Tank	American Car & Fdry. Co.
Erie	1	Dump	Koppel Industrial Car & Equipment Co.
Chicago, Milwaukee, St. Paul & Pacific	4	Dump	Western Wheeled Scraper Co
Total for month	2,788		

Passenger Cars

Name of Company	Number ordered	Type	Builder
Kansas City Southern	4	Baggage and Mail	Pullman Car & Mfg. Corp
Total for month	4		

Supply Trade Notes

THE OFFICES OF the American Railway Car Institute have been moved from 61 Broadway to 19 Rector street, New York.

THE PRESSED STEEL CAR COMPANY has moved its New York Office from 55 Broad street to 80 Broad street.

THE ALMA DRAFT GEAR CORPORATION has moved its offices from 110 East Forty-second street to 68 William street, New York.

A. W. LAUDER, general sales manager of the Lyon Metal Products Company, Aurora, Ill., has been elected vice-president.

FOOTE BROTHERS GEAR & MACHINE COMPANY, Chicago, has moved its general offices from 111 North Canal street to 215 North Curtis street.

THE PACIFIC CAR & FOUNDRY COMPANY has purchased the Bacon Matheson Forge Company and will move the facilities to Renton, Wash.

THE GALENA OIL CORPORATION has moved its New York office from 41 East Forty-second street to 25 West Forty-third street.

THE PATTERSON-SARGENT COMPANY has moved its New York office from 30 Church street to the Chrysler building, 135 East Forty-second street.

THE CURTIN-HOWE CORPORATION, New York, has moved its executive offices from 11 Park Place to the Chrysler building, 405 Lexington avenue.

THE PRESSED STEEL CAR COMPANY plans to rebuild part of its mill at Brandon avenue and 136th street, Chicago, which was destroyed by fire on April 8.

FLOYD K. MAYS, vice-president of the Bradford Corporation, New York, has been elected president, to succeed Horace Parker, resigned.

GEORGE W. H. ALLEN has been elected a director of the American Locomotive Company to succeed the late Frederick H. Stevens.

THE PITTSBURGH-DES MOINES STEEL COMPANY, Pittsburgh, Pa., has moved its New York office from 50 Church street to 270 Broadway.

EDWIN T. HALL, representative of the Sullivan Machinery Company, with headquarters at Boston, Mass., has been promoted to manager of this office to succeed George H. Richey, deceased.

A. C. MOTHERWELL, formerly in charge of forging plants at Detroit, Mich., and Flint, for the General Motors Corporation, has been appointed representative of the Standard Forgings Company, Chicago.

THE BUCYRUS-ERIE COMPANY, South Milwaukee, Wis., has taken over the manufacture and sales of the Loadmaster, a full-revolving boom crane, formerly marketed by Frederic H. Poor, Inc., New York.

CLARENCE H. HOWARD, chairman of the board of the General Steel Castings Corporation, Clarence H. Howard, Jr., manager of the foreign department, and E. Howard Hooper, assistant to the chairman, have resigned.

ALFRED F. HOWE, who retired as vice-president and general sales manager of the Borden Company, Warren, Ohio, in 1926 has been appointed western manager of this company, with headquarters at 717 Calmar avenue, Oakland, Cal.

WILLIAM L. BROWN, 1600 Arch street, Philadelphia, Pa., has been appointed a special agent of the Ohio Locomotive Crane Company, Bucyrus, Ohio, for the sale of its products in the southeastern territory.

THE HARNISCHFEGER SALES CORPORATION, Milwaukee, Wis., has moved its New York office from the Hudson Terminal building, 50 Church street, to the Empire State building, Thirty-fourth street and Fifth avenue.

FRANK K. TUTT, district manager of the Bird-Archer Company, New York, with headquarters in that city, has been elected vice-president, with headquarters in Chicago. H. C. Harrigan, vice-president, has been transferred to New York.

HARRY W. PETTY, formerly Cleveland district sales manager of the American Steel Foundries, has been appointed representative of the Union Steel Castings Company, with headquarters at Pittsburgh, Pa.

WILLIAM L. BROWN has been appointed special representative of the Argyle Railway Supply Company, Chicago, with headquarters at 1600 Arch street, Philadelphia, Pa., and will handle the sale of stoves and sand driers in that territory.

S. M. KINTNER, assistant to vice-president of the Westinghouse Electric & Manufacturing Company, with headquarters at East Pittsburgh, Pa., has been elected vice-president in charge of engineering, with the same headquarters.

WALTER H. WIEWEL has been appointed sales manager of The Timken Steel & Tube Company, Canton, Ohio, replacing A. J. Sanford, resigned. Mr. Wiewel has been associated with the company for several years as manager of steel sales in New York City. He will have his headquarters at Canton.

THE INTERNATIONAL DERRICK & EQUIPMENT COMPANY, Columbus, Ohio, and the Stacey Engineering Company which operates the P. H. & F. M. Roots Company and the Connersville Blower Company, Connersville, Ind., have merged, forming the International Stacey Corporation, with general offices in Columbus, Ohio.

J. B. BARTHOLOMEW, formerly western manager of sales engineers in the Chicago office of the Bethlehem Steel Company, has been appointed contract manager for the McClintic-Marshall Corporation, with headquarters at Chicago.

WILLIAM T. KILBORN, formerly vice-president and general manager of sales of the Graham Bolt & Nut Company, has been elected vice-president in charge of sales of the Hammond Bolt & Nut Corporation, Hammond, Ind., with general offices in the Peoples Gas building, Chicago.

THE GREAT NORTHERN has let contracts to the Railway Engineering Equipment Company, Chicago, for direct steaming systems in the enginehouses at Great Falls, Mont., and Whitefish and Williston, N. D., and for all pipe work in the power house and water treating plant at Great Falls.

THE HASKELITE MANUFACTURING CORPORATION, Chicago, has moved its New York office from 501 Fifth avenue to the Knickerbocker building, 152 West Forty-second street. Joseph A. Potchen was recently transferred to the New York territory in an engineering and sales capacity to succeed James J. Dunne.

ALCO PRODUCTS, INC., a division of the American Locomotive Company, has opened a district sales and construction office at 1203 Philtower building, Tulsa, Okla. M. A. Hayes is general superintendent in charge of construction; T. B. Leech is sales engineer. A similar office has been opened in the Esperson building, Houston, Tex., in charge of R. H. Brinton.

THE ARMCO RAILROAD SALES COMPANY, which handles the sales of wrought steel wheels, locomotive jacket sheets, car siding sheets and plates, and galvanized black and blue annealed sheets to the railroads for the American Rolling Mill Company, Middletown, Ohio, has opened a district sales office at 1120 Midland Bank building, Cleveland, Ohio. W. N. Crout is the district sales representative.

THE INDUSTRIAL BROWNHOIST CORPORATION, will consolidate the Cleveland, Ohio, and Bay City, Mich., manufacturing operations of the corporation in one plant at Bay City as promptly as conditions make **it possible to do so, retaining at Cleveland the general offices including the administrative, financial, sales, purchasing, accounting, and part of the engineering departments. Six to eight months will probably be required for the gradual transfer of manufacturing operations to Bay City.**

THE WHITCOMB LOCOMOTIVE COMPANY, Rochelle, Ill., has been organized as a subsidiary of the Baldwin Locomotive Works to take over the George D. Whitcomb Company following the purchase of the properties and going business at public auction on April 13. The company will continue to build gasoline, gas-electric, Diesel and Diesel-electric storage battery and trolley locomotives from three-ton to 100-ton rating. The officers of the com-

(Continued on next left-hand page)

pany are as follows: President, George H. Houston, president Baldwin Locomotive Works; vice-president, John P. Sykes, senior vice-president, Baldwin; vice-president and general manager, Harold H. Perry, formerly vice-president, Industrial Brownhoist Corporation, Cleveland, Ohio; Secretary, Arthur L. Church, secretary and assistant treasurer, Baldwin; treasurer Charles E. Acker, treasurer, Baldwin.

P. B. Bird, chairman of the board of the Bird-Archer Company, New York, has also been elected president to succeed L. F. Wilson, president and general manager, retired. After a brief leave of absence, Mr. Wilson will assume duties associated with the locomotive water conditioner and other mechanical equipment developed in the service of the company. J. E. O'Brien, vice-president, has been elected vice-president and general manager, with headquarters in Chicago.

Edward C. Bullard, vice-president and and director of the Bullard Company, Bridgeport, Conn., has been appointed general manager of that company to succeed

Edward C. Bullard

his uncle, the late Stanley Hale Bullard. Mr. Bullard is the first of the third generation of the family to assume so important a position in the organization. He is a native of Bridgeport, and received his early education in the Curtis School, Brookfield, and in the University School, Bridgeport, where he prepared for Yale (Sheffield) Scientific School, from which he was graduated in 1917 with honors. After familiarizing himself by actual contact with the duties of the several divisions of the Bullard Company plant, he was made assistant to his father, Dudley B. Bullard, chief engineer, in 1926. Three years later he was appointed an engineer in charge of design and research, and in 1930 was elected a vice-president.

William A. Callison, Jr., has been appointed a sales representative at Chicago, of the American Locomotive Company and the Railway Steel-Spring Company. After graduating from Purdue University, Mr. Callison spent a short time with the International Nickel Company, leaving there to spend two years at the Schenectady and Dunkirk works of the American Locomotive Company.

Glenn W. Christopher, manager of the bar and wire sales of the Youngstown Sheet & Tube Company, Youngstown, Ohio, has been promoted to assistant manager of pipe and sales, and has been succeeded by William W. Brown, district manager of sales at Pittsburgh, Pa., who, in turn, has been succeeded by Guy B. Strausner, district manager at Buffalo, N. Y. Mr. Strausner has been succeeded by Clyde F. Andler, district manager at Youngstown, and the latter has been succeeded by Earl H. Braunbern, assistant district sales manager at Youngstown. Robert D. MacKenzie, acting district sales manager at Cleveland, Ohio, has been appointed district sales manager to succeed G. G. Stuart, deceased.

The Shepard Niles Crane & Hoist Corporation recently changed its sales office in Pittsburgh, Pa., to the Grant building. Roy M. Hurst, for many years connected with the company and until recently in its New York office, is now in charge as district manager. Frank J. Kinney, who represented the company for many years in the Pittsburgh territory, is associated with Mr. Hurst at the Pittsburgh office. The corporation has also changed its sales office at Cleveland, Ohio, to 1433 East Twelfth street, with Harry A. Baugh in charge as district manager. Mr. Baugh was recently in its Chicago office and for many years served as district manager of the Pittsburgh office.

Obituary

Frederick W. Bruch, president of the Acme Machinery Company, Cleveland, Ohio, died on Wednesday, April 1.

Frederick V. Green, formerly vice-president of the Pittsburgh Testing Laboratory, died in New York City on April 16.

Elmer A. Laughlin, inventor of the Durable draft gear and other railway appliances, died in a fire on his farm near Oregon, Ill., on April 1.

George H. Richey, manager of the Boston, Mass., office of the Sullivan Machinery Company, died on April 1. Mr. Richey had been associated with the Sullivan Machinery Company since 1912, and was manager of its New England sales office in Boston from 1919 until his death.

W. W. Neale, traveling engineer for the American Arch Company, died on April 23 at Baltimore, Md. Mr. Neale had been connected with the American Arch Company for the past eighteen years, being formerly engaged in the mechanical department of the Baltimore & Ohio.

Joseph B. Terbell, chairman of the board of the American Brake Shoe & Foundry Company, who died on April 15, was born at Corning, N. Y., in February, 1863, and was graduated from Hamilton College in 1884 with the degree of A.B. He then served with the Fall Brook Railroad, now a part of the New York Central, and later was vice-president of the Corning Iron Works. He became president in 1897 of the Corning Brake Shoe Company, and in 1902, when that company was merged with the American Brake Shoe & Foundry Company, he was elected vice-president of the latter company in charge of the western business, with head-

Joseph B. Terbell

quarters at Chicago. Mr. Terbell subsequently served as vice-president at New York; in July, 1919, was elected president and in March, 1922, became also chairman of the board. He relinquished the duties of president in June, 1929, serving since that time as chairman of the board.

Joseph R. Ellicott, formerly eastern district manager of the Westinghouse Air Brake Company, died of heart disease at his home in Ormond Beach, Fla., April 16, at the age of 73 years. Mr. Ellicott was born in Batavia, N. Y., but his family later moved to Grand Rapids, Mich., where he received his early education. He entered railroad service at the age of fifteen as a fireman on the Michigan Central. In 1877 he was given a position in the claims department of the Chicago & North Western, and later became traveling auditor, first for the St. Paul, Minneapolis & Omaha, and then for the Chicago & North Western. He then became, successively, general manager of the Ajax Forge Company, Chicago; eastern sales manager of the Griffin Wheel & Foundry Company, New York; organizer and director of the General Agency Company, a railway supply company, New York, and in 1898 general manager of the Standard Air Brake Company. In 1901 the Standard Air Brake Company was taken over by the Standard Traction Brake Company, which in turn was controlled by the Westinghouse Air Brake Company. Mr. Ellicott became manager of the company, with headquarters in New York, and when the Westinghouse Traction Brake Company was formed to succeed the Standard Company, in 1903, he retained the position of manager of the new company. In 1905 he was appointed New York district manager both of the Westinghouse Traction Brake Company and the Westinghouse Air Brake Company. In 1919 Mr. Ellicott was relieved of active duty and since that time had remained in a consulting capacity. He was for several terms president of the American Electric Railway Association.

(Continued on next left-hand page)

Personal Mention

General

E. SCHMITZ, traveling engineer of the Chicago, Milwaukee, St. Paul & Pacific at Montevideo, Minn., has been appointed traveling engineer on the LaCross-River division, first district.

J. C. SHREEVE has been appointed superintendent of motive power of the Elgin, Joliet & Eastern, with headquarters at Joliet, Ill., succeeding J. Horrigan who has retired after nearly 37 years of continuous service with the E. J. & E.

J. E. INGLING, assistant to general manager of the Erie, has been appointed supervisor of fuel and locomotive operation, with headquarters at New York.

THE JURISDICTION of T. McFarlane, traveling engineer of the Chicago, Milwaukee, St. Paul & Pacific, Eastern lines, has been extended to include the Iowa and Southern Minnesota division, second district.

Master Mechanics and Road Foremen

J. E. HARDY has been appointed road foreman of engines of the Birmingham division of the Southern, with jurisdiction between Birmingham, Ala., and Atlanta, Ga., and Birmingham Terminal.

H. E. LOGAN, road foreman of locomotives on the Chicago, Burlington & Quincy at Galesburg, Ill., has been promoted to master mechanic of the Centerville division at Centerville, Iowa.

THE JURISDICTION of William Joost, master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis., has been extended to include the Madison division.

THE JURISDICTION of F. P. Miller, master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Portage, Wis., has been extended to include the second district of the La Crosse-River division.

THE JURISDICTION of A. M. Martinson, master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Mason City, Iowa, has been extended to include the second district of the Iowa and Southern Minnesota division.

JOHN A. TURTLE, master mechanic on the Union Pacific at Denver, Colo., since 1903, retired from active duty on April 1 after more than 50 years in the service of the mechanical department of that railroad.

JOHN TURNEY, master mechanic of the Twin City terminal and the River, Iowa, Minnesota and Duluth divisions at Minneapolis, Minn., has been transferred to the Sioux City and Dakota Division at Sioux City, Iowa, succeeding W. C. Kenney, who has been assigned to other duties.

J. S. FORD, master mechanic of the Centerville division of the Chicago, Burlington & Quincy at Centerville, Iowa, has been transferred to the La Crosse division at North La Crosse, Wis., succeeding C. W. Robertson, who at his own request has been assigned to other duties.

Car Department

J. R. CONNORTON has been appointed supervisor of air brakes of the Erie, with headquarters at Meadville, Pa.

WILLIAM McCABE, car repairman of the Reading, has been promoted to the position of assistant car foreman, Wayne Junction shop, Philadelphia, Pa.

G. H. HIGLEY has been appointed general air brake inspector of the Erie, with headquarters at Meadville, Pa., succeeding T. W. Dow, retired.

Shops and Enginehouse

J. H. STALLINGS, a machinist at the Finley shop of the Southern at Birmingham, Ala., has been promoted to the position of assistant foreman, machine shop.

R. H. HARRINGTON, night enginehouse foreman of the Southern at Forrest shop, Sheffield, Ala., has been promoted to the position of general foreman.

T. P. KELLY, gang foreman in the boiler erecting shop of the Pennsylvania at Altoona, Pa., has been appointed acting assistant foreman, boiler shop.

W. S. EDMISTON, assistant foreman in the boiler shop of the Pennsylvania at Altoona, Pa., has been appointed acting foreman of the boiler shop at Juniata.

G. G. SICKLES, gang foreman in the boiler erecting shop of the Pennsylvania at Altoona, Pa., has been appointed acting assistant foreman of the boiler erecting shop.

THE JURISDICTION of G. Lamberg, shop superintendent of the Chicago, Milwaukee, St. Paul & Pacific at Minneapolis, Minn., has been extended to include the Twin City terminal and Duluth division.

ANTON MEYER, assistant foreman in the boiler erecting shop of the Pennsylvania at Altoona, has been promoted to the position of foreman of the boiler erecting shop.

Purchasing and Stores

CLYDE L. WAKEMAN, has been appointed general storekeeper of the Wabash, with headquarters at St. Louis, Mo.

E. A. ERNST, district storekeeper on the Chicago, Rock Island & Pacific at Shawnee, Okla., has been transferred to Horton, Kans., succeeding C. H. Schneider, deceased.

J. C. GLENN has been appointed division storekeeper of the Central of New Jersey and the New York & Long Branch, with headquarters at Elizabethport, N. J., succeeding C. A. Marshall, resigned.

THE POSITION of district storekeeper of the Chicago, Rock Island & Pacific at Shawnee, Okla., has been abolished and C. P. Clark appointed division storekeeper at that point.

RALPH I. RENFREW has been appointed district storekeeper of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Beech Grove, Ind., succeeding C. V. Coulter, retired.

F. M. BAUMGARDNER, who served as master mechanic on the Illinois Central at Clinton, Ill., from 1912 to 1914, died at his home at Detroit, Mich., on April 16.

EDWARD J. SUMMERS, fuel supervisor of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Chicago, died at his home in that city on April 15.

THOMAS J. JOHNSON, foreman of the wheel and axle shop of the Nashville, Chattanooga & St. Louis at Nashville, Tenn., who retired four years ago, died at his home in Nashville on April 1.

CHARLES H. SCHNEIDER, district storekeeper on the Chicago, Rock Island & Pacific, with headquarters at Horton, Kan., died at St. Luke's hospital, Chicago, on March 21.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

CUTTING TOOLS.—"Cutting Costs with Cutting Tools" is the title of a new booklet issued by the O. K. Tool Company, Shelton, Conn., in which the principle of the O. K. serrated tooth system is described.

LOADMASTER.—The new bulletin published by the Bucyrus-Erie Company, South Milwaukee, Wis., describes and illustrates the Loadmaster, a small crane unit having a full-revolving boom. The unit, mounted on wheels or crawlers, can pass through an opening 66 in. wide and requires a head clearance of only 8 ft. 10 in.

WELDING.—"Better Welds with Armco Ingot Iron" is the title of the new 40-page booklet of the American Rolling Mill Company, Middletown, Ohio. The booklet opens with a chapter describing Armco ingot iron, which is immediately followed by a chapter showing where the iron is used by welders. Another chapter contains useful engineering data and the addenda describes miscellaneous welding operations.

Railway Mechanical Engineer

Founded in 1832 as the American Rail-Road Journal
With which are also incorporated the National Car Builder, American Engineer and Railroad Journal, and Railway Master Mechanic. Name Registered, U. S. Patent Office

Shop Equipment Number, June, 1931

Volume 105 *No. 6*

Motive Power Department:

Car Department

General:

Editorials:

The Reader's Page:

Car Foremen and Inspectors:

Back Shop and Enginehouse:

New Devices:

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Railway
Mechanical Engineer

Founded in 1832 as the American Rail-Road Journal

June - 1931

Chesapeake & Ohio Locomotive Shops at Huntington, W. Va.*

The manufacturing tool room

A detailed analysis of machine operations in the Huntington shops to determine the number, size and capacity of machine tools necessary to produce a balanced operation of all departments

IN designing the locomotive shops at Huntington, W. Va., the mechanical officers of the Chesapeake & Ohio had a definite objective in mind—to provide the maximum locomotive heavy repair capacity with the least possible detention from service and at a minimum expenditure of labor. Exhaustive studies of locomotive repair programs as related to the conditions of operation indicated the desirability of a shop capable of turning out, when operated at maximum capacity, two locomotives which had received Class 2 or 3 repairs for each full working day.

Complete detail time studies were first made to determine the number of machinery operations necessary to repair a given number of locomotives per month which automatically determined the number, size and capacity of the machine tools necessary to produce a balanced shop operation in all of the several departments in the shop. The result of this study was to locate machinery in groups for each separate kind of work and in the proper sequence of operations to avoid all unnecessary handling of parts and materials.

* This is the second article describing the facilities of the Huntington shops—the first appeared in the May issue.

A careful analysis of the time studies indicated the desirability of having several machines in the shop designed by the machine tool builders for special production work so as to be able to meet the output time required on certain parts without unnecessary duplication of machine tool facilities. Among these special machines are certain milling machines used on driving boxes and on shoes and wedges that have made marked reductions in the time required to machine these parts.

The work of the shop is segregated into definite groups and each group has been equipped with such machine tool and shop facilities as will enable that group to perform all of the operations on the parts assigned to it. With very few exceptions each group is a self-contained unit working on one class of locomotive parts and equipped only with those machines required for work on that class of parts. In one or two groups there is sufficient excess machine capacity to permit handling certain operations for other groups where it can be done without the uneconomical handling of parts or material.

Preliminary Time Studies

Detailed analyses were made of the machine-tool

The brass room and air-brake department

operations for all of the groups in the shop. These analyses permitted the tentative selection of the machine units in each group. The time studies for the various operations were based upon the output of a normal number of locomotive parts involved in the process of Giving Class 2 or 3 repairs to the following number and types of locomotives:

33—type 2-8-2 locomotives equipped with superheaters, boosters, feedwater heaters and stokers
9—type 2-6-6-2 Mallet compound articulated locomotives equipped with superheaters and Walschaert valve gear
8—type 2-8-8-2 Mallet simple articulated locomotives, equipped with Walschaert valve gear, superheaters and feedwater heaters

making a total of 50 classified repairs for each working month of 25 eight-hour days.

After a tentative selection of machine tools was made for each group the operations were carefully analyzed to determine the possibility of eliminating machines in the original layout by the selection of special machines designed for continuous production. For example, under ordinary railroad shop conditions, using the planer or plain table milling machines with single or double heads the production time on new cast-steel driving boxes would vary from five to seven hours. In the schedule planned for the new Huntington shop on the definite-output basis it is necessary to complete an average engine set of driving boxes in four hours or less. With ordinary machine equipment this would have required the installation of at least two and possibly three machines working on driving boxes alone to care for the finishing of new boxes and the refinishing of new liners on old boxes each month. The problem was met by the installation of a multi-cutter milling machine of special design having a revolving table which permits setting up one set of boxes while the other is being finished. Preliminary estimates allowed 45 minutes as the average time for the milling of the inside faces, edges and shoe and wedge fits. Actual production when the shop is working for maximum output is at the rate of 20 boxes in eight hours or an average time, including set-ups, of 24 minutes for each box. A study on shoes and wedges resulted in the installation of a similar machine which reduced the average time from 30 minutes to less than nine minutes.

Tables I, II and III show in detail the method used in making the machine tool analyses. While similar information was worked up for all the groups in the shop the data shown for Groups 1, 2 and 3 are typical and sufficient to serve as an example of how closely the final layout of the shop resembled the preliminary studies. It will be noticed that the actual machine hours on each operation were increased by 25 per cent to allow for the additional machine-tool capacity required for shop order work in addition to the regular locomotive repair work. It is of interest to note that after a year's operation, the actual percentage of man-hours applied to locomotive repair work averages 76.4 per cent leaving 23.6 per cent of the total shop man-hours for manufacturing and shop order work. The 25 per cent additional machine capacity, in this case, was accurately estimated.

Table IV shows a summary of the estimates of the machine capacity required for all of the groups in the shop. The total machine hours—34,884—shown in the analysis is actually 92 per cent of the potential ma-

Table I—Analysis of Machine Operations Required To Perform 50 Class 2 and 3 Repairs a Month—Group 1—Driving Wheels

Machine and operation	Total no. of parts	Per cent of parts repaired	No. of parts repaired	Time for each part Hr.	Min.	Total machine hours Hr.	Min.	Total time for machining, hr.
96-in. vertical boring mill:								
Bore, turn and face new driving-wheel centers	500	10	50	6	0	300	00	
Bore, turn and face trailer-wheel centers	100	5	5	2	0	10	00	
Bore, turn and face smoke-arch rings	50	5	2½	2	30	6	15	
Turn smoke-box fronts	50	5	2½	1	0	2	30	318.8
Total, plus 25 per cent for shop-order work								398.8
72-in. radial drill:								
Drill and tap counterbalance	500	10	50	1	0	50	00	
Drill main crank pins	134	20	26.8	0	30	13	24	
Drill front and intermediate crank pins	200	20	40	1	0	40	00	
Drill back crank pins	98	20	19.6	0	10	3	16	
Drill and tap driving-wheel centers for hub liners	500	10	50	1	0	50	00	
Drill and tap trailer-wheel center for hub liners	100	5	5	1	0	5	00	161.7
Total, plus 25 per cent for shop-order work								202.1
24-in. Morton keyway cutter:								
Cut keyway in driving-wheel centers	500	10	50	0	20	16	40	
Cut keyway in eccentric arms	100	10	10	0	18	3	00	19.7

View of the Turret lathe department

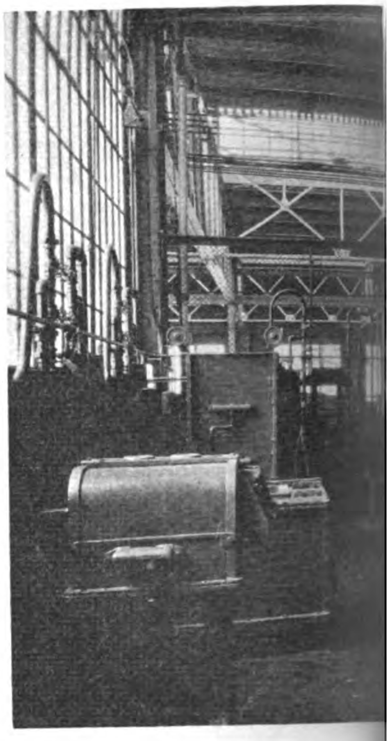
Total, plus 25 per cent for shop-order work								24.6
90-in. double wheel quartering machine:								
Bore crank pin holes in new wheel centers and true up old pins (20 per cent of total pairs used, assuming one new wheel center for each pair of wheels)	250 pr.	20	50 pr.	0	42	35	00	
True-up crank pin holes in old wheel centers and true-up old crank pins	250 pr.	80	200 pr.	0	42	140	00	175.0
Total, plus 25 per cent for shop-order work								218.8
90-in. driving-wheel lathe:								
Turn driving-wheel tires	250 pr.	75	187½ pr.	1	0	187	30	187.5
Total, plus 25 per cent for shop-order work								234.4
90-in. driving-wheel lathe:								
Turn driving-wheel tires	250 pr.	25	62½ pr.	1	0	62	30	
Turn trailer-wheel tires	50 pr.	100	50 pr.	0	35	29	10	91.7
Total, plus 25 per cent for shop-order work								114.6
90-in. journal turning lathe:								
True up and roll journals; face hub liners on driving wheels	250 pr.	75	187½ pr.	1	30	281	18	281.3
Total, plus 25 per cent for shop-order work								351.5
90-in. combination journal turning lathe:								
55-in. combination journal truing and alxe turning machine:								
True up and roll journals; face hub liners on trailer wheels	50 pr.	75	37½ pr.	1	30	56	15	
True up and roll journals; face hub liners on engine truck wheels	50 pr.	75	37½ pr.	1	15	47	00	
True up old trailer-axle journals		30	12	30	0	25	50	50
True up old tender-truck axle journals	250	50	125	0	30	62	30	177.3
Total, plus 25 per cent for shop-order work								221.3
Newton locomotive axle keyseating machine:								
Cut keyways in driving axles	522	25	130½	0	30	65	15	65.3
Total, plus 25 per cent for shop-order work								81.6
30-in. by 8-ft. 6-in. engine lathe:								
Turn driving axles	250	15	37½	5	0	187	30	187.5
Total, plus 25 per cent for shop-order work								234.4
28-in. by 8-ft. 4½-in. double-head axle lathe:								
Turn driving axles	250	10	25	5	0	125	00	
Turn trailer axles	50	25	12½	4	0	50	00	175.0
Total, plus 25 per cent for shop-order work								**218.8**
24-in. by 5-ft. 6-in. engine lathe:								
Turn and fit main crank pins	134	20	26.8	4	0	107	12	
Fit crank pins, front and intermediate	200	20	40	1	00	40	00	
Thread and fit crank pins, back	98	20	19.6	0	15	4	54	152.1
Total, plus 25 per cent for shop-order work								189.9
24-in. shaper:								
Shape crank-pin keys	134	20	26.8	0	40	17	54	
Shape driving-axle keys	500	25	125	0	40	83	18	
Shape expansion plugs	100	30	30	0	30	15	00	116.2
Total, plus 25 per cent for shop-order work								**145.3**
600-ton hydraulic driving wheel press:								
Press off driving wheels	250 pr.	35	87½ pr.	0	30	43	45	
Press on driving wheels	250 pr.	35	87½ pr.	0	30	43	45	
Press off trailer wheels	50 pr.	30	15 pr.	0	25	6	15	
Press on trailer wheels	50 pr.	30	15 pr.	0	25	6	15	
Press out crank pins	500	70	350	0	18	105	00	
Press in crank pins	500	70	350	0	18	105	00	
Press off booster-axle gears	6	34	2	0	30	1	00	
Press on booster-axle gears	6	34	2	0	30	1	00	312.0
Total, plus 25 per cent for shop-order work								390.0
60-in. by 72-in. tire-heating furnace								
Counterbalancing stand								
Lead melting pot and furnace								
Two portable electric-welding outfits								
One double dry grinder								
Total number of machine hours for Group No. 1 required for 50 locomotives a month								**2,421.1**
Total number of machine hours plus 25 per cent for shop-order work								3,026.4

chine capacity of the 190 machines in the shop that are operated on locomotive repair and shop order work. This not only indicates the accuracy of the preliminary studies but corroborates the statement that there was practically no duplication of machine tool units between the different groups.

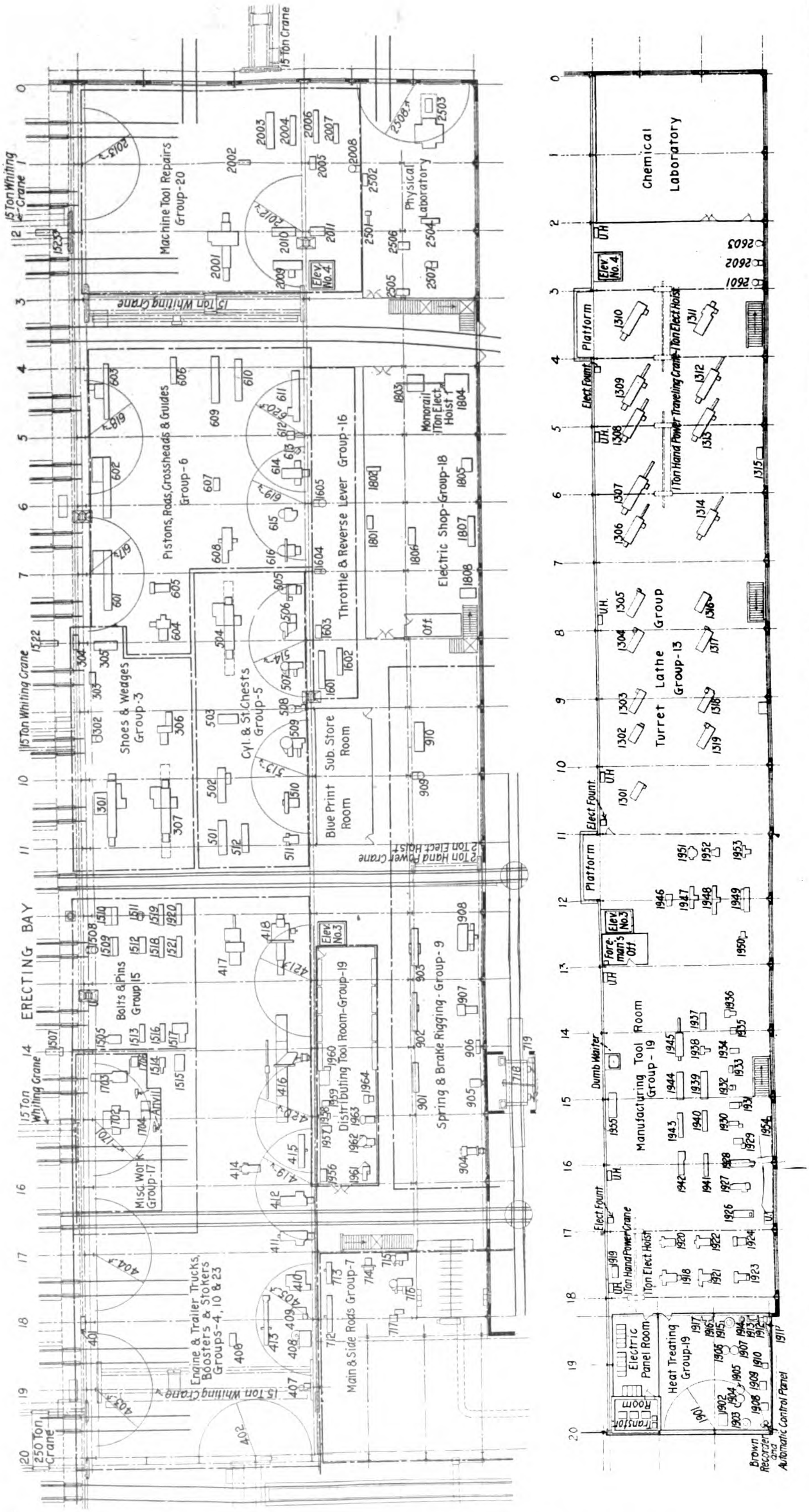
Group Operations

The drawings showing the layout of the several bays and departments of the shop show the location of the machine tools and other facilities in each group.

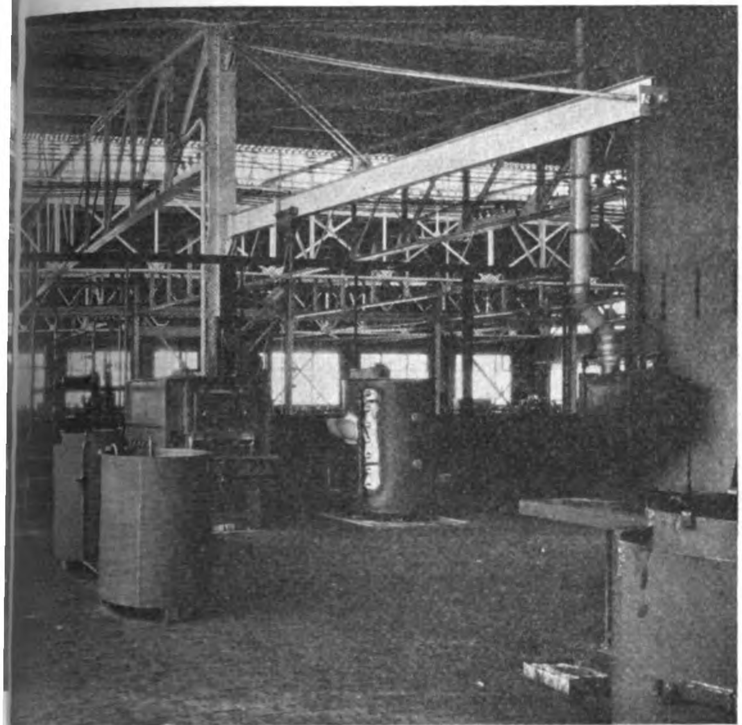
Group No. 1—The locomotives are lifted off the wheels on track No. 22 in the erecting bay and rolled in-



Above—Furnaces in the tool heat-treating department, all of which are equipped with recording pyrometers and are fitted with automatic temperature control devices.



Left—The two machine bays and the West Side balcony—The greater part of the machine work is handled in these two bays while the second floor of the west side of the shop contains the tool room, turret lathe department and the chemical laboratory



to the wheel bay where the driving boxes are removed. The grease cellars are taken apart and any remaining grease is placed in a container for delivery to the oil house. The wheels are then placed in the large lye-vat at the north end of the wheel bay and left there a sufficient length of time for thorough cleaning. After removal from the cleaning vat they are placed on the grating adjacent to the vat and washed off with clean water; all finished surfaces are greased and the wheels are placed on the storage track in sets until they are scheduled to start on the rounds of the repair process.

The equipment in the wheel shop is so arranged that after the wheels are properly inspected, the tires and axles OK'd or condemned and the crank pins OK'd for turning or condemned, the tires are removed if necessary, the counterbalance is checked and, if necessary, new tires are applied. The mounted wheels are then delivered to the wheel press where the axles and crank pins condemned by the inspector are pressed out and new axles are applied, the wheels are delivered to the quartering machine to have the crank-pin holes quartered and then returned to the press to have the new crank pins applied. On wheels where the axles are not removed they are delivered to the wheel press for crank-pin removal, thence to the journal-truing lathe for turning up the journals before sending to the quartering machine. After the crank-pin holes have been bored and the wheels quartered the mounted wheels are returned to the press to have the crank pins pressed in. The completed wheels, at this stage, are at tracks 11 or 12 from which the movement to any track in the erecting shop is over the shortest possible distance. A detailed analysis of operations is shown in Table I.

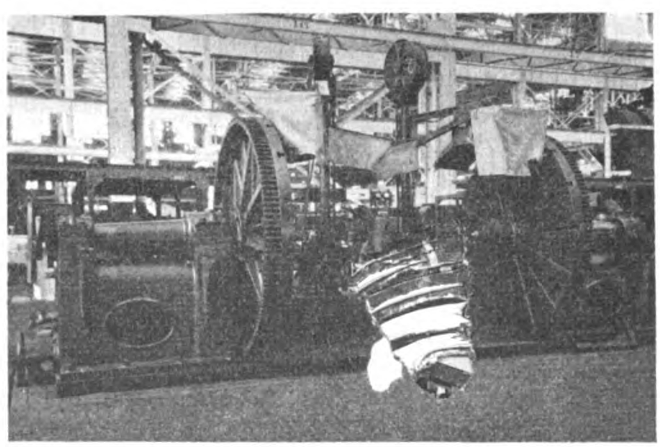
Group No. 2—When the driving boxes are removed from the wheels they are placed in metal baskets and placed in the lye vat for cleaning. After cleaning they are delivered to the driving box repair group where the process of repair is as follows:

1—Press out the old crown brass.
2—Cut off the driving-box hub liner on vertical turret lathe.
3—Remove the shoe and wedge liner when it will not finish ¾ in. below standard.
4—True up crown-brass fit on driving box shaper.
5—Drill and tap holes for new patch bolts.
6—Fit new crown brass on drawcut shaper.
7—Press in new crown brasses on hydraulic press.
8—Drill and ream holes in new crown brass.
9—Apply brass hub liner and shoe and wedge liners where necessary with brass melted in electric furnace.
10—Finish shoe and wedge surfaces on semi-automatic miller.
11—Restore driving-box cellar fit to standard.
12—Fit the cellar to the box and remove cellar.
13—Store driving boxes with cellars removed until orders for final finishing are received from the erecting shop on suitable forms provided for the purpose.
14—Bore and face driving boxes on orders from the shop.
15—Drill oil holes.
16—Complete bench work and deliver to two-ton hand-driven cranes for handling boxes while fitting onto finished driving wheels.
17—Apply suitable spreader to prevent boxes from turning over and deliver driving wheels in complete sets to the extension tracks from the erecting shop into the wheel bay in front of the engines to which they belong.

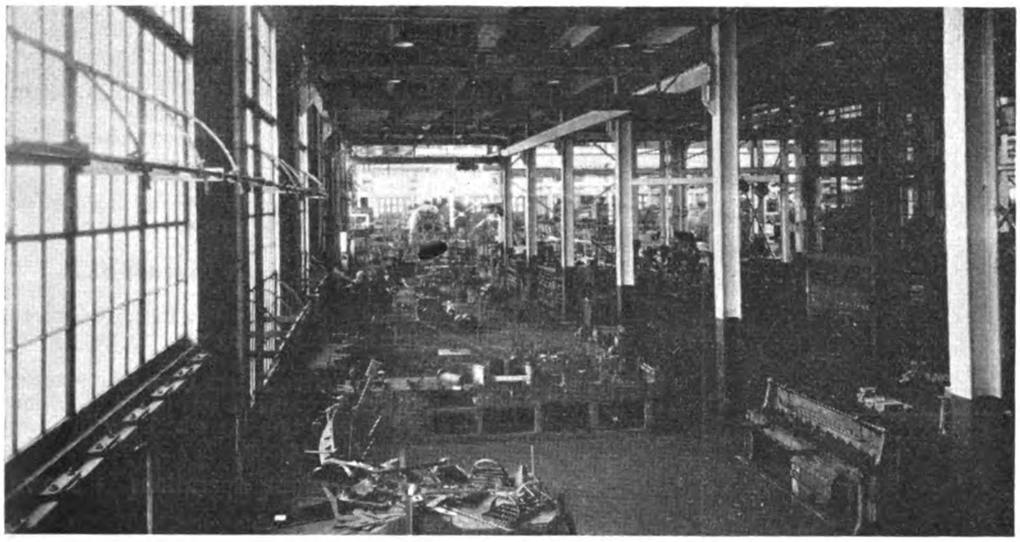
A detailed analysis of machine operations is shown in Table II.

Table II—Analysis of Machine Tool Operations Required To Perform 50 Class 2 and 3 Repairs a Month—Group No. 2—Driving Boxes

Machine and operation	Total no. of parts	Per cent of parts repaired	No. of parts repaired	Time for each part Hr.	Time for each part Min.	Total machine hours Hr.	Total machine hours Min.	Total time for machining, hr.
36-in. by 16-ft. three head driving-box milling machine:								
New driving boxes—mill inside faces, edges and shoe and wedge faces; one set-up	500	10	50	0	45	37	30	
Mill shoe and wedge faces of old driving boxes after new liners (brass) have been poured	500	100	500	0	15	125	00	162.5
Total, plus 25 per cent for shop-order work								203.1
48-in. by 18-ft. planer:								
Dovetail shoe and wedge faces on new driving boxes	500	10	50	1	0	50	00	50.0
Total, plus 25 per cent for shop-order work								62.5
42-in. Bullard vertical turret lathe:								
Face new driving boxes and dovetail for hub liners	500	10	50	1	30	75	00	
Cut-off hub liners and true dovetail on old driving boxes	500	90	450	0	20	150	00	225.0
Total, plus 25 per cent for shop-order work								281.3
54-in. driving-box boring and facing machine:								
Bore and face hub plates on old and new driving boxes	500	100	500	0	25	208	00	208.0



Wheel lathe equipped for building up wheel centers by electric welding



Part of the jacket shop in the foreground with the air-pump department shown in the background

Total, plus 25 per cent for shop-order work								260.0
30-in. driving-box slotter:								
Slot driving-box crown brass and cellar faces (new boxes)	500	10	50	0	40	33	18	
True up crown-brass face of old driving boxes	500	90	450	0	20	150	00	183.3
Total, plus 25 per cent for shop-order work								229.1
30-in. Morton draw-cut shaper:								
Plane crown brass on new and old driving boxes	500	100	500	0	48	400	00	400.0
Total, plus 25 per cent for shop-order work								500.0
30-in. Morton draw-cut shaper:								
Shape driving-box cellars	500	20	100	0	30	50	00	50.0
Total, plus 25 per cent for shop-order work								62.5
4-ft. radial drill with 6-ft. arm:								
Drill and tap new driving boxes for hub liners and shoe and wedge liner bolts	500	10	50	1	30	50	00	
Drill and tap old driving boxes for hub liner and shoe and wedge liner bolts	500	60	300	0	30	150	00	200.0
Total, plus 25 per cent for shop-order work								250.0
4-ft. radial drill with 6-ft. arm:								
Drill and ream driving boxes for crown brass plugs (new boxes)	500	10	50	0	20	16	42	
Drill and ream driving boxes for crown brass plugs (old boxes)	500	90	450	0	10	75	00	91.7
Total, plus 25 per cent for special-order work								114.6
4-ft. radial drill with 6-ft. arm:								
Drill new driving boxes and cellars and tap for bolts	500	10	50	0	20	16	42	
Drill old driving boxes and cellars and tap for bolts	500	90	450	0	10	75	00	
Drill oil holes in new driving boxes	500	10	50	0	20	16	42	
Drill oil holes in old driving boxes	500	90	450	0	15	112	30	220.9
Total, plus 25 per cent for shop-order work								276.1
100-ton hydraulic press (vertical):								
Press out crown brasses	500	100	500	0	5	41	42	41.7
Total, plus 25 per cent for shop-order work								52.1
100-ton hydraulic pre[illegible] cal):								
Pressing in crown b[illegible]	500	100	500	0	5	41	42	41.7
Total, plus 25 per [illegible] for shop-order work								52.1
Electric brass furnace:								
Casting hub liners and shoe and wedge liners on driving boxes	500	100	500	0	30	250	00	250.0

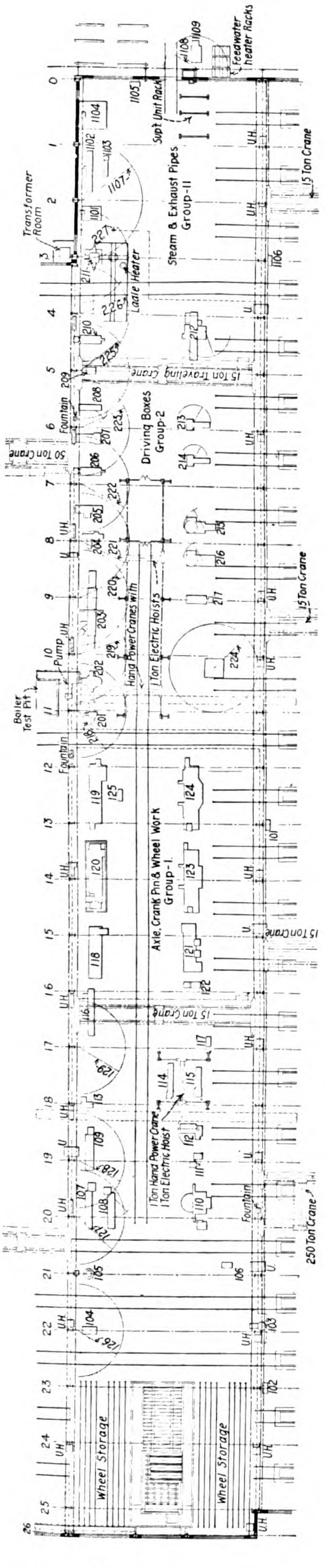
Total, plus 25 per cent for shop-order work	312.5
Total no. of machine hours in Group No. 2 for 50 locomotives a month	2,124.8
Total no. of machine hours plus 25 per cent for shop-order work	2,655.9

Group 3—When the shoes and wedges are removed from the locomotives they are placed in the cleaning vat for the removal of grease and dirt and then delivered to the shoe and wedge group where they are inspected, liners applied where necessary to all except main-wheel shoes and wedges and then they are matched up into sets for delivery to the erecting shop for the purpose of being laid off to line. New shoes and wedges are machined on a 36-in. Newton milling machine with a special table which permits setting up one set while the other is being machined. On this machine the shoes and wedges are milled on the outside for the driving-box fit and on the inside for the frame fit. A 24-in. vertical drill press takes care of the drilling of shoes and wedges for liners. When the shoes and wedges are returned from the erecting shop they are struck off to line and planed. A detailed analysis of machine operations is shown in Table III.

Group 4—This group of machines takes care of such work as pilot beams, deck castings and special parts required at infrequent intervals.

Group 5—In this group cylinder bushings are bored, turned and cut off. Cylinder and piston-valve heads, valves, balance plates, false valve seats and valve yokes are planed on a crank planer. Equalizer and brake fulcrums, brake hangers and levers, throttle lever and reverse-lever parts are machined on a crank planer. This group also looks after the work with portable boring bars on boring out and truing-up valve-chamber bushings and cylinder bushings. Cylinder and piston-valve packing rings are machined here. The 42-in. vertical turret lathes bore, turn and face piston-valve followers and bushings, cylinder heads and piston-valve heads. An 18-in. slotter performs a variety of operations on valve yokes and followers, throttle-lever yokes and fulcrums, equalizers, spring hangers, spring saddles and driver-brake hanger and fulcrum brackets. A No. 4 milling machine mills the ports in piston-valve bushings and false valve seats and performs a number of operations on throttle- and reverse-lever parts.

Group 6—This group is equipped with sufficient machinery to handle all necessary repairs to pistons and



Wheels and driving boxes are handled in this bay

rods, crossheads and guides. New bull rings are applied to piston spiders by machines that are grouped together and served by a jib crane, a drill press for drilling the new bull rings, a pneumatic riveter for driving the new rivets and an electric heater for heating the rivets. There is also a 200-ton press in this group, served by the same

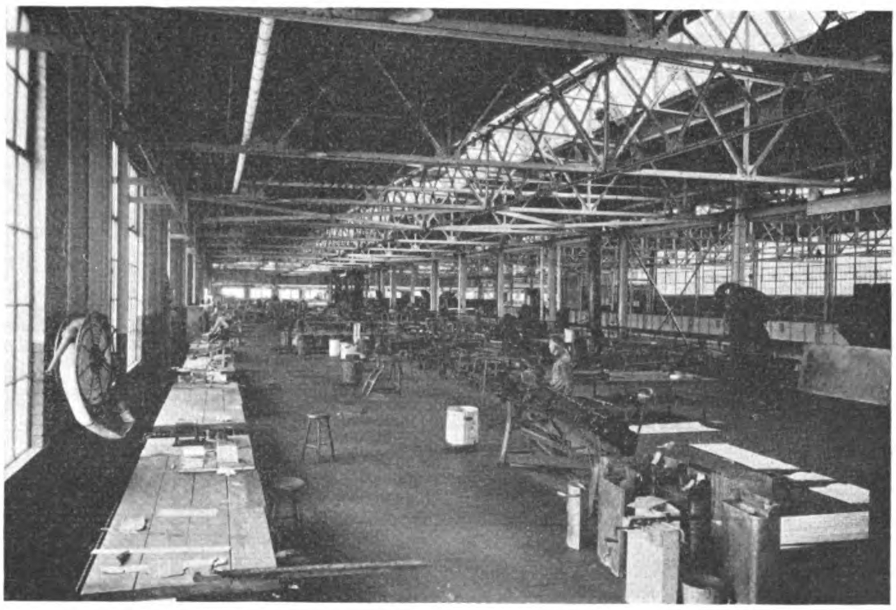
Table III—Analysis of Machine Tool Operations Required To Perform 50 Class 2 and 3 Repairs a Month —Group No. 3—Shoes and Wedges

Machine and operation	Total no. of parts	Per cent of parts repaired	No. of parts repaired	Time for each part Hr.-Min.	Total machine hours Hr.-Min.	Total time for machining, hr.
36-in. by 16-ft. horizontal milling machine:						
Mill shoes and wedges on inside and outside (new)	1000	75	750	0 9	112 30	112.5
Total, plus 25 per cent for shop-order work						140.6
24-in. vertical drill press:						
Drill old shoes and wedges for liners	1000	25	250	0 6	25 00	25.0
Total, plus 25 per cent for shop-order work						31.3
38-in. by 14-ft. planer:						
Plane shoes and wedges to line	1000	75	750	0 15	187 30	187.5
Total, plus 25 per cent for shop-order work						234.5
32-in. crank planer:						
Plane shoes and wedges to line	1000	25	250	0 25	104 12	104.2
Total, plus 25 per cent for shop-order work						130.3
Total number of machine hours for Group No. 3 for 50 locomotives a month						429.2
Total number of machine hours plus 25 per cent for shop-order work						536.5

crane, for the application of new piston rods. Locomotives receiving classes 1, 2 or 3 repairs have the piston rods ground or renewed, and the valve stems and slide-valve yoke stems are ground, fitted up with packing rings and provided with suitable protection for transportation to the erecting floor. All piston rods and valve stems are coated with grease after fitting up to prevent rusting.

The guides on all locomotives receiving Classes 1, 2 and 3 repairs are ground on the three wearing surfaces on a guide grinder. Bronze crosshead shoes are manufactured in quantities on the shoe and wedge milling

Below—A view of the tin shop on the second floor of the North wing of the Mallet shop



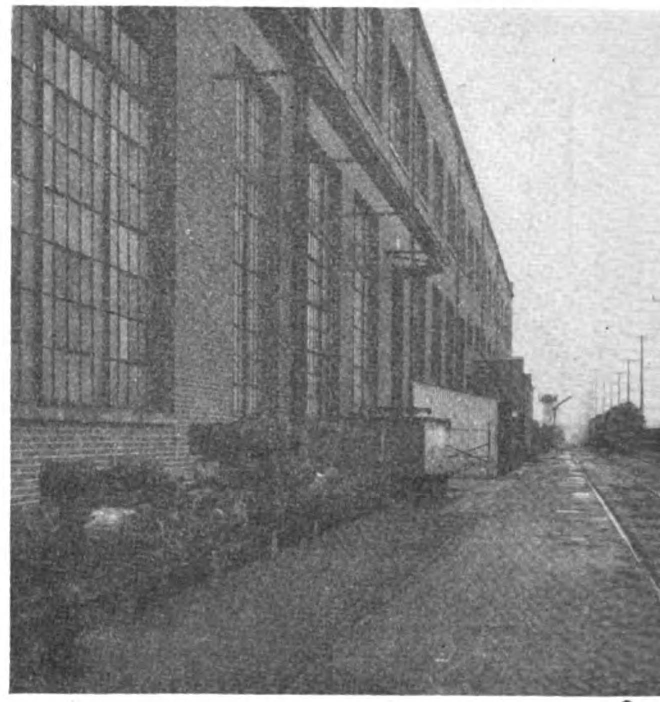
machine mentioned in Group 3. The guide fit of these new crosshead shoes is machined to the smallest standard size and fitted on a crank planer to the guides with which they are to be used.

Group 7—Main and side rods are removed from the locomotives in the stripping section of the shop adjacent to the rod department. When delivered to this group they are cleaned and inspected, annealed if necessary and fitted with new brasses, restored to standard length and delivered to the erecting shop. All new main and side rods for the entire system are manufactured at the Huntington shop.

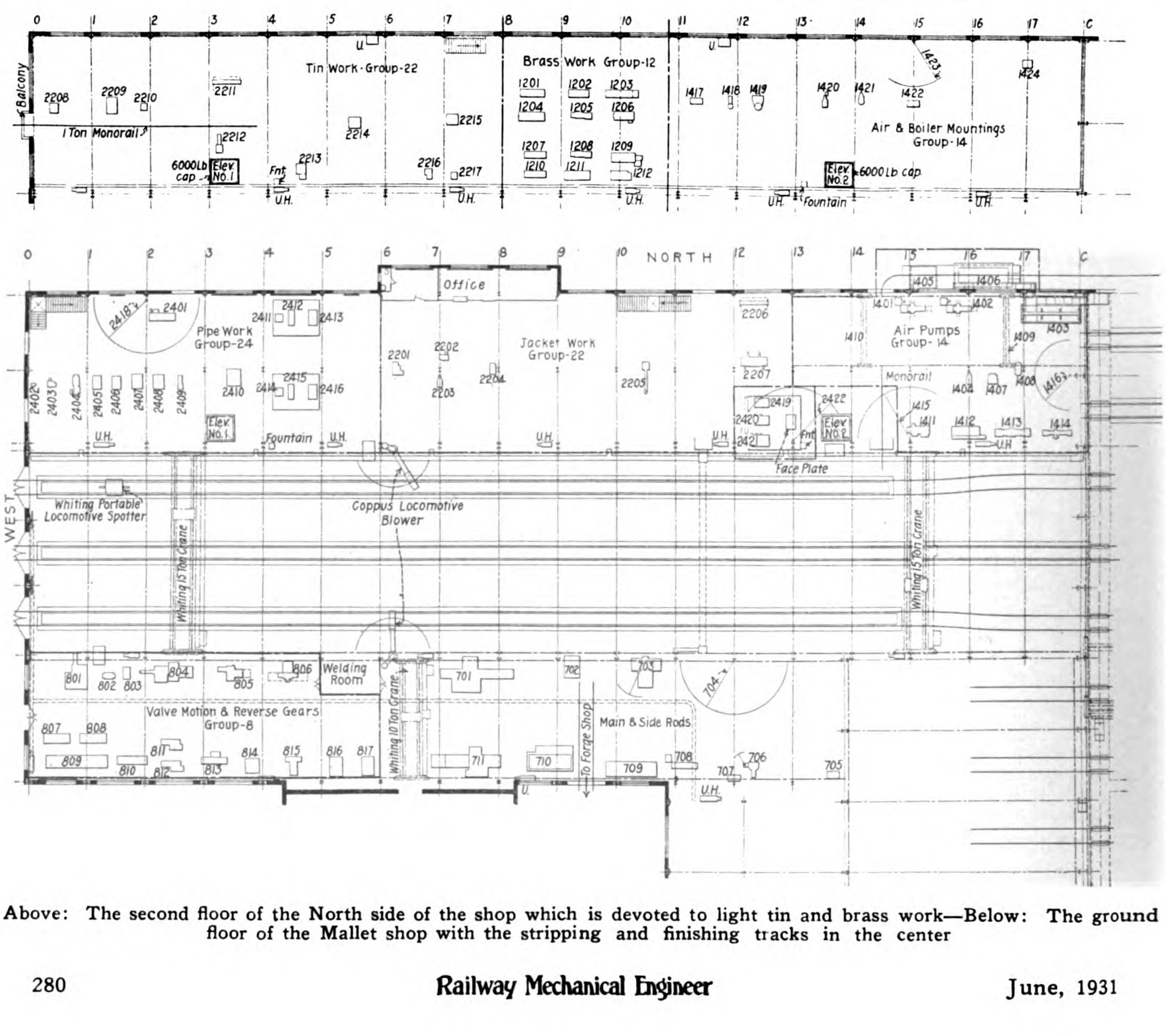
New main and side rods and rod straps are machined on a 48-in. horizontal milling machine. A 54-in. milling machine mills the rods to length, mills the ends and straps and the forked ends of side rods. A 15-in. slotter handles a variety of jobs on motion work while several types of drilling machines handle the drilling work in this group. A double-head rod boring mill bores the new side rods, back-end main-rod straps and the front end of main rods for the bushings.

Rod bushings are turned and bored on a 24-in. vertical turret lathe and knuckle pins, knuckle-pin bushings and main-rod strap bolts are finished up on engine lathes. A 50-ton power press presses the rod and knuckle-pin bushings out and in.

Group 8—The location of this group adjacent to the stripping and finishing tracks where the valve-motion parts are removed and applied permits the overhauling of the parts with a minimum of handling. After the



The North side of the shop—The coal transfer conveyor is shown in the distance and the monorail hoist for handling air pumps to the cleaning vat and to storage is shown on the side of the building



Above: The second floor of the North side of the shop which is devoted to light tin and brass work—Below: The ground floor of the Mallet shop with the stripping and finishing tracks in the center

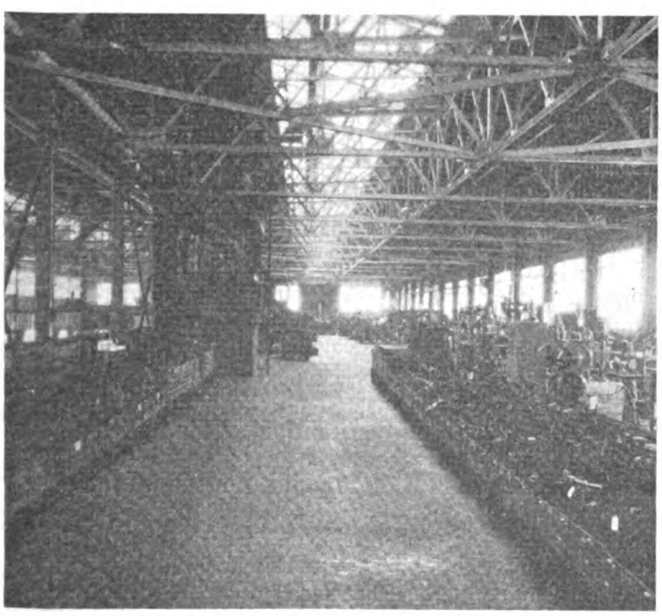
parts are removed from the locomotives they are placed in metal baskets and thoroughly cleaned in the lye vat before delivery to the valve-motion group. In this group

Table IV—Summary of Estimated Machine Hours Required in Various Groups to Perform 50 Class 2 and 3 Repairs a Month

Group no.	Department	Straight machine hours	Total, plus 25 per per cent for S.-O. work	No. machines involved
1	Driving wheels, engine- and trailer-truck wheels, axles and crank pins	2421.1	3026.4	17
2	Driving boxes	2124.8	2655.9	16
3	Shoes and wedges	429.2	536.5	4
4	Frames, deck and draw castings, deck and pilot beams	1578.5	1973.2	14
5	Cylinders and heads, steam chests and valves	3371.8	4214.1	17
6	Pistons and rods, crossheads and guides	1691.8	2114.1	16
7	Main and side rods	1718.7	2148.5	14
8	Valve and reverse gear	2753.1	3440.3	18
9	Spring and brake rigging	1979.8	2474.7	10
10	Engine and trailer trucks, boosters and stokers	See Group No. 4	.....	..
11	Steam and exhaust pipes, superheaters and units, and feedwater heaters	235.9	294.9	2
12	Brass work, cab and boiler mountings	1636.4	2045.5	13
13	Turret-lathe work	4119.2	5149.0	19
14	Air-brake and pneumatic devices	1061.0	1327.0	10
15	Bolts and pins	2550.0	3187.5	18
16	Drifting, intercepting and by-pass valves; throttle, reverse-lever and cylinder-cock rigging	217.0	271.2	2
23	Miscellaneous work, grate and ash-pan rigging and large castings	See Group No. 4	.....	..
	Totals	27888.9	34859.4	190

are all of the machines and other equipment necessary to complete the manufacture and repair operations. The completed parts are finished all over and are polished with portable buffing machines.

All of the motion pins and bushings used on the C. & O. are finished to standard size and gage so that the fitting is a matter of the selection of the proper sizes from stock. Motion pins are manufactured on turret lathes after which they are hardened and ground. The straight body of the pin is ground to a standard size for the part involved and the taper fits for the rods are ground in step sizes on a taper of ¾ in. in 12 in. Plug gages are used for selecting the sizes and these gages are marked A, B, C and D, the markings of the gage being ½ in. apart and varying, on the ¾-in. in 12-in. taper, 1/32 in. in diameter for each step. The pins



Small parts and materials are handled almost entirely on skids

in stock are similarly marked. The taper fits on the pins are ground so as to leave 1/32 in. clearance between the shoulder on the pin and the inside of the rod jaw for drawing up. Motion bushings are of standard inside diameters and the outside diameters are ground to four step sizes.

Group 9—When the brake and spring-rigging parts are removed from the locomotives they are taken to the annealing furnace to have the grease burned off and as soon as cold are delivered into storage. This group is provided with sufficient machinery to be self-supporting, except for bushings, which are manufactured to standard gage in the turrent-lathe group. All brake and spring-rigging parts when undergoing repairs are restored to original blueprint dimensions.

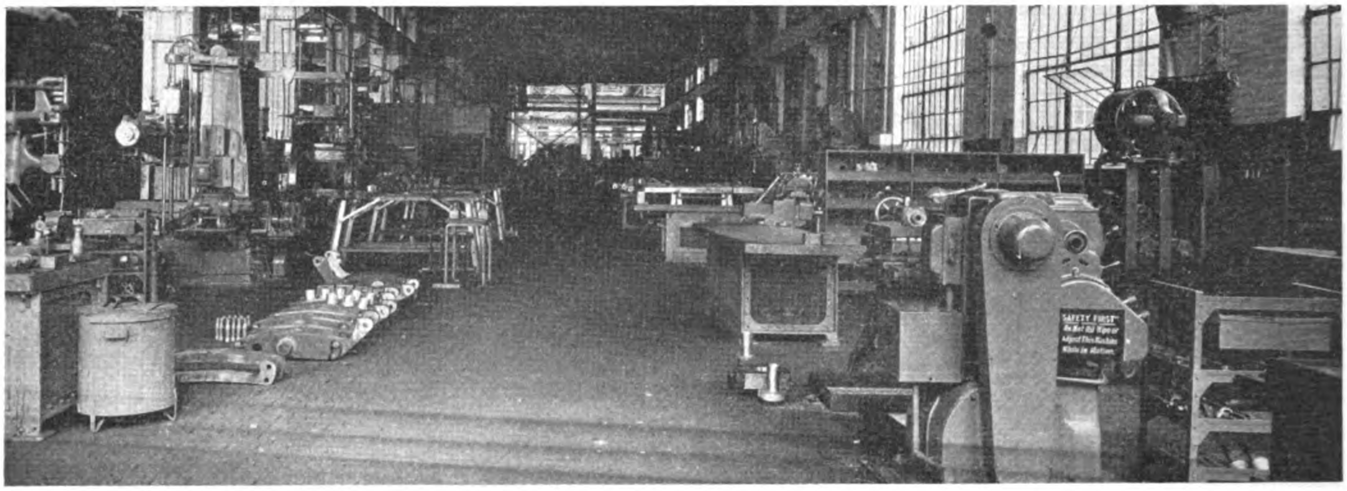
Group 10—The machine work for this group is combined with that of Groups 4 and 23 most of it being of a special nature on engine and trailer trucks, boosters and stokers. The group is self-supporting as far as machinery is concerned and is equipped with a steam hammer for fitting braces, binders, etc.

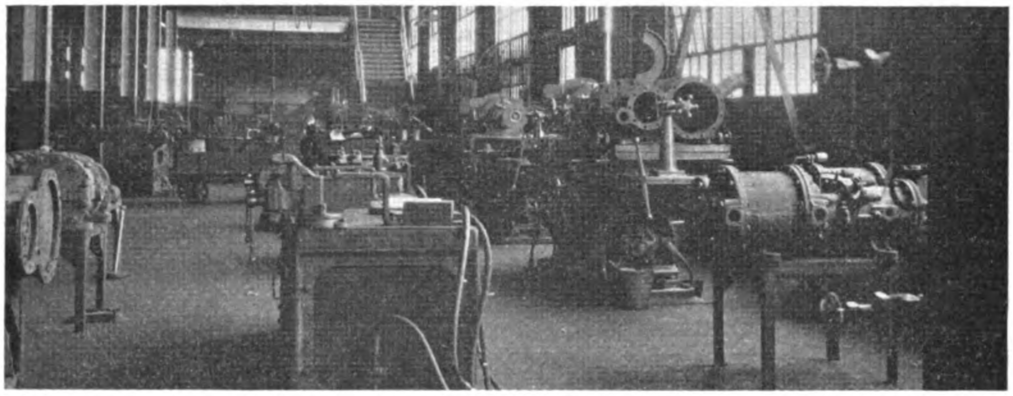
Group 11—This group is located at the south end of the wheel bay and handles all of the steam and exhaust-pipe work, including throttle boxes, feedwater-heater drums and the testing and repairing of all superheater units. The material awaiting repairs is stored immediately outside the shop under the south crane runway. There is a small cleaning vat located in this group for cleaning feedwater-heater-tube bundles.

Group 12—This is the manufacturing brass department. Here all cab and boiler mountings and air-brake equipment except pumps are repaired. The cab and boiler mountings are removed from the locomotives in the stripping position and the parts are placed in specially designed metal boxes which are handled by lift trucks. Two types of boxes are used, one for boiler mountings that will be required to make the boiler water-tight for test, including blow-off cocks, boiler checks, safety valves, auxiliary domes and washout and arch plugs and the other box for cab mountings and air-brake apparatus such as brake valves, distributing valves, headlight generator, injector, lubricator, steam and air gages and similar equipment. These boxes are arranged with suitable partitions providing space for each of the articles. When the stripping is completed the boxes are delivered to the brass group on the second floor of the north bay of the longitudinal shop by means of the elevator where they are placed on lift skids until the parts which they contain are scheduled for repairs. Upon completion of the repair work on the parts, the box containing the boiler mountings necessary to fit the boiler for water test is delivered to the erecting shop and box No. 2 is delivered to the finishing tracks with the air-brake apparatus and trimmings.

Group 13—This is the turret-lathe group located on the second floor over the light machine bay. It is a manufacturing group and all of the work of this group is handled on a production basis in small or large lots.

Group 14—This group is located adjacent to the stripping position where air pumps, feedwater-heater pumps, pneumatic fire doors, grate shakers and power reverse gears are removed from the locomotive. When these parts are taken off they are placed on the floor under the end of a monorail crane which runs to the outside of the north end of the shop and along the shop wall. There is a break in the crane runway and a monorail traveling crane having two 4,000-lb. trolleys operates on another runway at right angles to the first runway and serves the entire floor area of the air-pump repair group where the large units must be handled in making repairs.





Above — Valve motion and reverse gear group

Left — Machine tool equipment used in the air - pump department

Three Micro grinders handle the internal grinding on air-pump, feedwater-heater pump, stoker-engine cylinders and reverse-gear cylinders and a Landis 16-in. by 72-in. horizontal grinder takes care of the work on pump and reverse-gear piston rods.

Air-Compressor Test Rack

In this group there is a pump test rack of sufficient size to accommodate all of the pumps that may be necessary to test at one time. The pumps are mounted on the test rack with special bolts of the "fitting-up" type using a tapered key so that they may be mounted and removed with practically no loss of time except that required to remove the pipe fittings. All pumps are tested under steam and the compressed air is piped into the shop air line while the exhaust steam goes into the low-pressure shop heating system.

A handy piston storage rack constructed of structural shapes permits the storage of about 40 pistons at a time. The holes in the horizontal bars of the rack are two inches in diameter to accommodate the largest rod and are fitted with copper ferrules to prevent damage to the finished surface of the rod.

Group 15—All bolts are manufactured in this group to stock sizes. Tapered bolts are manufactured to standard gage sizes and locomotive taper reamers are equipped with collars and index numbers corresponding to their size, the purpose of which is to ream the holes to standard size as determined by the collar on the reamer and then obtain from stock a bolt already turned which is then cut off to the proper length and threaded.

Group 16—This group contains the necessary machine equipment for repairing intercepting and by-pass valves, reverse and throttle levers and cylinder-cock rigging.

The pipe and tin shop is located adjacent to the stripping and finishing positions. When the pipe work is removed from the engine it is taken to the shop where it is inspected. The pipe which is unfit for further service is scrapped and the rest is repaired and stored on racks just outside the shop until needed for re-application to the engine when it goes out of the shop.

The jackets are removed and sent to the jacket shop for examination. Damaged or worn parts are scrapped and replaced while all the good parts are stored on racks outside the north side of the jacket shop until needed for re-application.

The tin work in this department involves the repair of tin ware and is handled on the second floor over the pipe shop. The small parts are handled in boxes on an elevator and the larger pieces are handled on a hoist at the west end of the shop which raises them to a platform on the second floor where they are handled through the shop on a monorail hoist.

Other Departments

Group 20 is a machine-tool repair department equipped with new machines. It handles machine tool repairs for all points on the C. & O. system. Machines requiring major repairs or overhauling are shipped to Huntington to have this work performed.

A blueprint room is located on the main floor of the shop for the filing and distribution of blueprints to the shop. A blueprint machine is located here for use in making prints from shop tracings made in the shop draftsman's department.

Sub-store rooms each in charge of a storekeeper issue small bolts, nuts and washers, cotter keys, marking chalk and other small supplies that are required for the application of ash pans, front-end and various other patching around a locomotive, the needs for which cannot be ac-

curately determined in advance. This avoids delay in the erecting shop.

Distributing tool rooms are located in the boiler shop and the machine shop. The one in the machine shop is located under the manufacturing tool room on the second floor and the transportation of small tools is effected by means of a dumb waiter.

Group 18—The electrical repair shop is located near the southwest corner of the shop under the turret-lathe department and is equipped with all the necessary apparatus for repairing and testing headlight and train-control equipment as well as motors, generators, electric storage-battery trucks and other electrical apparatus for the entire system.

In the extreme southwest corner of the shop is located a physical testing laboratory and directly overhead on the second floor a chemical laboratory. These laboratories are completely equipped with the usual testing and chemical apparatus and the work is handled under the supervision of the mechanical engineer and engineer of tests for the entire system.

Machine Tools and Shop Equipment in the Huntington Locomotive Shops

GROUP 1—WHEELS AND AXLES

101, 102 Hisey-Wolf double-end dry grinders
103 Hyde 15-in. electric Gypsy
104 Swift electric tire heater
105 Stewart No. 8 soft metal melting furnace (Spencer turbo-compressor)
106 Westinghouse 200-amp. portable electric arc welder
107 Betts 30-in. extra heavy end-drive axle lathe
108 Niles 28-in. two-carriage axle lathe
109 Newton locomotive axle keyseat milling machine

(Machine Tools and Shop Equipment—Continued)

110 Betts 96-in. boring mill
111 Morton 24-in. keyseater
112 Niles 72-in. radial drill
113 Steptoe 24-in. shaper
114 Betts 26-in. geared-head lathe
115 Lodge & Shipley 24-in. engine lathe
116 Niles 96-in. 600-ton hydrostatic wheel press
117 Safety double-end emery grinder
118 Putman 90-in. journal lathe
119 Niles 90-in. driving wheel journal lathe
120 Niles 90-in. wheel-grinding machine
121 Niles 84-in. driving-wheel lathe (equipped for welding driving-wheel centers)
122 General Electric motor-generator set
123, 124 Sellers 90-in. driving-wheel lathes
125 Westinghouse 200-amp. portable electric arc welder
126, 127, 128 20-ft. 4,000-lb. jib cranes; 2-ton American "Lo-hed" electric hoists
129 20-ft. 5-ton jib crane; 5-ton American "Lo-hed" electric hoist

GROUP 2—DRIVING BOXES

201 Watson-Stillman 100-ton hydraulic press
202 Colburn vertical boring and turning mill
203 Sellers 48-in. by 48-in. by 18-ft. planer
204 Baker 30-in. slotter
205 Morton 38-in. draw-cut shaper
206, 210 American 6-ft. plain radial drills
207 Morton 32-in. draw-cut shaper
208 Morton 30-in. draw-cut shaper
209 Chambersburg 100-ton hydraulic forcing press
211 Detroit Standard type A electric brass-melting furnace
212 Newton L 66 driving-box milling machine
213 Morton 36-in. draw-cut shaper
214 Morton 32-in. draw-cut shaper
215, 216 Sellers 54-in. boring and facing mills
217 American 6-ft. plain radial drill
218, 219, 220, 221, 222, 223, 225, 226 20-ft. 4,000-lb. jib cranes; 1-ton American "Lo-hed" electric hoists
224 19-ft. Conkey 1½-ton mast crane; 1-ton American "Lo-hed" electric hoist
227 20-ft. 4,000-lb. jib crane; 2-ton American "Lo-hed" electric hoist

GROUP 3—SHOES AND WEDGES

301 Newton special shoe and wedge milling machine
302 Edlund round-column drilling machine
303 Hisey-Wolf double-end dry grinder
304 Bridgeport 16-in. by 3-in. double-end dry grinder
305 Cincinnati 32-in. back-geared shaper
306 Newton 32-in. crank planer
307 Niles 44-in. by 44-in. by 14-ft. planer

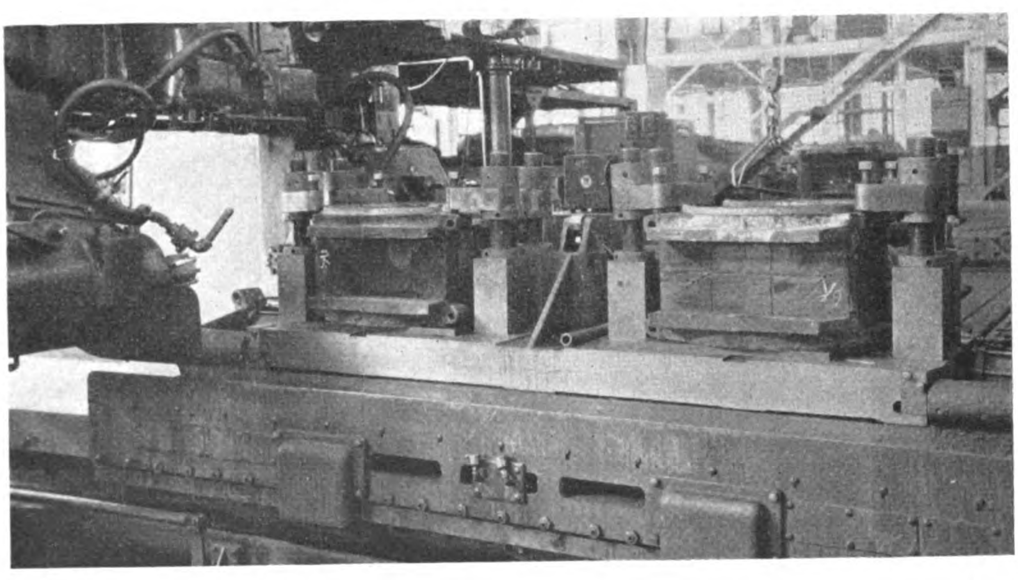
GROUPS 4, 10 AND 23—PILOT BEAMS, DECK CASTINGS, AND UNUSUAL JOBS

401, 406 Hisey-Wolf double-end dry grinders
402, 403, 404 40-ft. 4,000-ton jib cranes; 2-ton American "Lo-hed" electric hoists
405 20-ft. 4,000-lb. jib crane; 1-ton American "Lo-hed" electric hoist
407 Champion 20-in. upright drill
408 Bullard 42-in. vertical turret lathe
409 Gould & Eberhardt 24-in. back-geared shaper
410 5-ft. radial drill
411, 412 American 6-ft. radial drills
413 Lodge & Shipley 22-in. by 12-ft. engine lathe
414 Niles-Bement-Pond 18-in. slotter
415 Lodge & Shipley 24-in. by 5-ft. 6-in. engine lathe
416 Gray 48-in. by 48-in. by 18-ft. open-side planer
417 Ohio Model 5-T horizontal boring and drilling machine
418 Niles-Bement-Pond 42-in. by 14-ft. planer
419, 420 20-ft. 4,000-lb. jib cranes; 2-ton American "Lo-hed" electric hoists

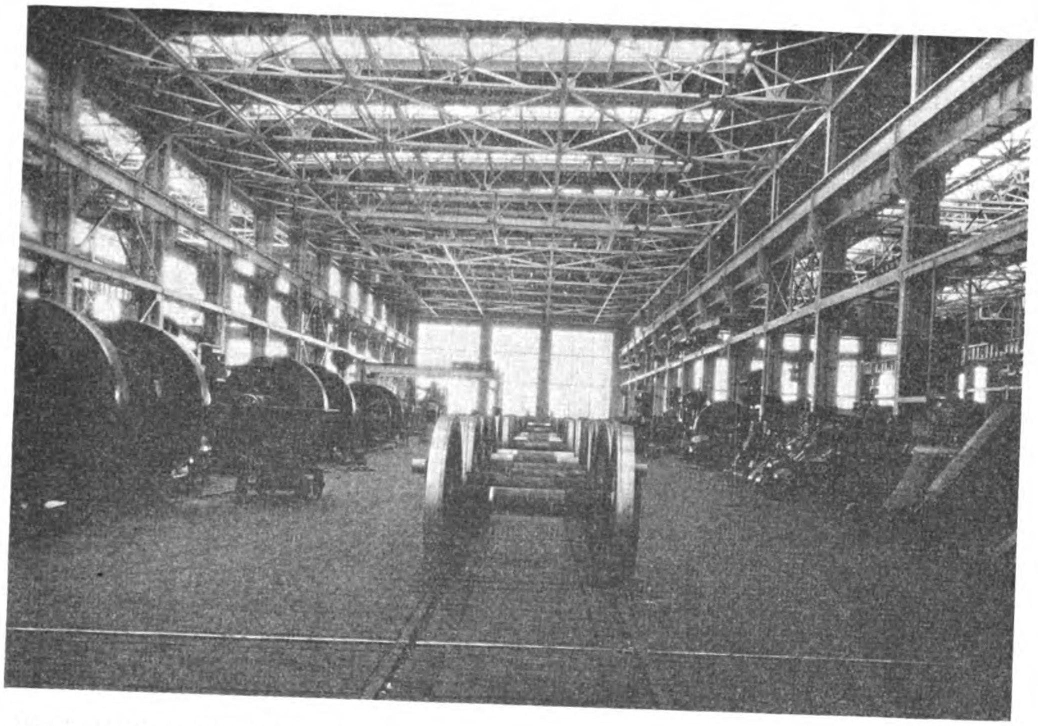
GROUP 5—CYLINDERS AND STEAM CHESTS

501 Lodge & Shipley 27-in. engine lathe
502 Newton 32-in. crank planer
503 Bement-Miles 15-in slotter
504 Niles 48-in. by 48-in. by 14-ft. planer
505 King 42-in. vertical turret lathe
506 Niles 42-in. vertical turret lathe
507 Bullard 36-in. vertical turret lathe

Above — Independent, small-capacity cranes and jib cranes are used to relieve the demand on the larger main-shop cranes



Right—A special driving box miller which can machine 20 new driving boxes in eight hours



View of the wheel bay showing the heavy machinery, aisle room and the wheel tracks.

508 Barnes No. 3, 34-in. drill
509 Bullard 54-in. vertical turret lathe
510 Cincinnati No. 4 plain milling machine
511 Le Blond No. 3 universal milling machine
512 Boye & Emmes 18-in. by 4-ft. 8-in. engine lathe
513, 514 20-ft. 4,000-lb. jib cranes; 1-ton electric hoists

GROUP 6—Piston Rods

601, 602 Diamond 30-in. face grinders
603 Landis 16-in. by 40-in. by 120-in. grinder
604 Newton 32-in. by 32-in. by 32-in. crank planer
605 Baker 18-in. vertical drill
606 Reed 20-in. engine lathe
607 Hisey-Wolf double-end dry grinder
608 Niles No. 3 double cotter drill
609 Bullard 34-in. engine lathe
610 American 20-in. by 14-ft. engine lathe
611 Chambersburg 66-in. 400-ton high-speed wheel press
612 Hanna 12-in. by 12-in. 50-ton riveter
613 Berwick No. 3 electric rivet heater
614 American 4-ft. plain radial drill
615 Bullard 36-in. vertical turret lathe
616 Colburn 42-in. vertical boring and turning mill
617, 618, 619, 620 20-ft. 4,000-lb. jib cranes with 1-ton American "Lo-hed" electric hoists

GROUP 7—Main and Side Rods

701 Newton 48-in. horizontal rod milling machine
702 Niles-Bement-Pond No. 10 vertical milling machine
703 Newton 54-in. single-spindle vertical rod milling machine
704 18-ft. radius jib crane, 4,000-lb. capacity, 1-ton electric hoist
705 Edlund round-column drilling machine
706 Watson-Stillman 100-ton hydraulic press
707 Hisey-Wolf double-end dry grinder
708 Micro FG 18-in. grinder
709 Newton S-27 duplex rod boring machine
710 Sellers 84-in. radial drill
711 Ingersoll 54-in. by 16-in. horizontal rod milling machine
712, 713 Lodge & Shipley 18-in. by 12 ft. engine lathes
714 Gould & Eberhardt 20-in. shaper
715 Bullard 24-in. vertical turret lathe
716 Bullard 36-in. vertical turret lathe
717 Morton 18-in. keyseater
718 DeRemer-Blatchford car-bottom annealing furnace
719 Buffalo direct blower

GROUP 8—Valve-Motion Parts

801 Newton radius link grinder
802 Hisey-Wolf double-end dry grinder
803 Edlund 24-in. drill press
804 Ohio 4-T horizontal boring, drilling and milling machine
805 Newton 32-in. crank planer
806 Kempsmith No. 5 plain high-power milling machine
807, 808 Monarch 18-in. by 8-ft. geared head lathes
809 Niles 56 in. engine lathe
810 Boye & Emmes 18-in. engine lathe
811, 812 Landis 6-in. by 18-in. plain grinding machines
813 Heald No. 72-A internal grinding machine
814 Gould & Eberhardt 20-in. shaper
815 Baker 18-in. vertical drill
816 Bullard 36-in. vertical turret lathe
817 Bement Miles 15-in. stroke slotter

GROUP 9—Spring and Brake Rigging

901 Reed 20-in. engine lathe
902 Lodge & Shipley 18-in. by 12-ft. engine lathe
903 Lodge & Shipley 30-in. engine lathe
904 Foote-Burt 36-in. vertical drill
905 Champion upright 20-in. drill
906 Hisey-Wolf double-end dry grinder
907 Baker 18-in. vertical drill
908 Colburn special 3-spindle drilling machine
909 Edlund round-column vertical drill
910 Gisholt 3½-in. by 36-in. turret lathe

GROUP 11—Exhaust Pipes, Throttles, Feedwater Drums and Superheater Units

1101 Niles 60-in. radial drill
1102 Pond 32-in. triple-geared engine lathe
1103 Reed 18-in. engine lathe
1104 Superheater-unit testing rack
1105, 1106 Hisey-Wolf double-end dry grinders
1107 25-ft. 4,000-lb. jib crane; 1-ton American "Lo-hed" electric hoist
1108 14-ft. jib crane; chain hoist
1109 Lye vat for feedwater-heater tubes

GROUP 12—Brass Manufacturing Department

1201, 1202 Lodge & Shipley 18-in. engine lathes
1203 Lodge & Shipley 20-in. engine lathe
1204, 1211 American 24-in. Fox lathes
1205, 1208 Sidney 18-in. by 6-ft. Monotrol engine lathes
1206 Warner & Swasey No. 4 turret lathe
1207, 1210 American 18-in. Fox lathes
1209 Gisholt 3½-in. by 36-in. turret lathe
1212 Brown & Sharpe No. 6 automatic screw machine

GROUP 13—Turret Lathe Production Department

1301 Cleveland 1½-in. automatic stud machine
1302 Browne & Sharpe No. 6 automatic tool machine
1303, 1317, 1318, 1319 Jones & Lamson 2¼-in. by 24-in. flat turret lathes
1304 Jones & Lamson 2-in. by 24-in. flat turret lathe
1305 Jones & Lamson 3-in. by 36-in. flat turret lathe
1306, 1314 Warner & Swasey No. 2-A Universal turret lathes
1307, 1310 Warner & Swasey No. 4-A Universal turret lathes
1309, 1312 Warner & Swasey No. 3-A Universal turret lathes
1311 Gisholt 6¼-in. by 42-in. turret lathe
1315 Hisey-Wolf double-end dry grinder
1316 Warner & Swasey No. 4 turret lathe

GROUP 14—Air and Heater Pumps, Fire Doors, Grate Shakers and Reverse Gears

1401, 1402 Micro model FG 18-in. grinders
1403 Air pump test rack
1404 Edlund type 3-D drilling machine
1405 Washing platform
1406 5-ft. by 17-ft. lye vat
1407 Avey 12-spindle No. 3 drill
1408 Hisey-Wolf double-end dry grinder
1409, 1410 2-ton hand-power traveling crane, 23-ft. 6½-in. span with 2-ton electric hoists
1411 Micro model DG grinder
1412 Landis 16-in. by 72-in. cylinder grinder
1413 American 20-in. by 8-ft. high-duty lathe
1414 American 14-in. by 8-ft. high-duty lathe
1415 18-ft. 4,000-lb. capacity jib crane with 2-ton electric hoist
1416 12-ft. 4,000-lb. capacity jib crane with 2-ton electric hoist
1417 Bridgeport 16-in. by 3-in. double-end grinder
1418 Champion 20-in. upright drill
1419 Covel-Hanchett No. 800 vertical grinder with Buffalo blower
1420 Rockwell 21-in. drill press
1421 Edlund drilling machine
1422 Hisey-Wolf 18-in. by 2½-in. double-end grinder
1423 15-ft. radius jib crane; one-ton chain hoist
1424 Foster rotary and lap plate truing machine

GROUP 15—Bolts and Pins

1505 Pels bar shear
1507, 1522, 1523 American 16-in. portable engine lathes
1508 Edlund round-column drilling machine
1509 Special four-spindle bolt turning machine
1510 Bush four-spindle bolt turning machine

1511 Whiton 3½-in. bolt centering machine
1512 Special bolt centering facing and pointing machine
1513 Acme 2-in. bolt pointer
1514 Pawtucket No. 1 Victor nut facer
1515 Landis 2-in. double-head bolt threader
1516 Acme 1½-in. bolt pointer
1517 Detrick & Harvey No. 4 triple-head bolt turner
1518, 1519, 1520, 1521 Sidney 14-in. by 6-ft. engine lathes

GROUP 16—Throttle and Reverse Lever

1601 Hendey 24-in. engine lathe
1602 Reed 18-in. engine lathe
1603 Hisey-Wolf double-end dry grinder
1604 Buffalo 20-in. upright drill
1605 Edlund round-column drilling machine

GROUP 17—Miscellaneous Work

1701 20-ft. 4,000-lb. jib crane; 1-ton American "Lo-hed" electric hoist
1702 Bement Miles 800-lb. steam hammer
1703 Walter Stock adjusting machine
1704 Johnson 36-in. by 36-in. oil-burning blacksmith forge
1706 Watson-Stillman ¾-in. by 2-in. 2-plunger vertical pump

GROUP 18—Electric Shop

1801 Bridgeport 16-in. by 3-in. double-end grinder
1802 Barnes 20-in. drill press
1803 Insulating-paint vat for dipping motors
1804 Electric armature baking oven
1805 Electric service 40-in. insulation shears
1806 Underwood 3-in. pneumatic pipe bender
1807 18-in. Hendey engine lathe
1808 Landis 2-in. double pipe and nipple machine

GROUP 19—Manufacturing Tool Room

1901 18-ft. 4,000-lb. jib crane; 1-ton chain hoist
1902 Stewart No. 11 oven furnace with Brown control valve and Brown recording pyrometer
1903 Stewart muffle furnace with Brown control valve and Brown recording pyrometer
1904, 1907 Water tanks
1905, 1906 Oil tanks
1908 Stewart No. 3 double-deck furnace with Brown registering pyrometer
1909 Stewart No. 17 rectangular furnace with Brown control valve
1910 Stewart No. 28 oven furnace
1911 Motor-driven turbo-compressor
1912, 1917 Leeds-Northrup temperature recording panels
1913, 1916 Leeds-Northrup automatic temperature control panels
1914 Homo No. 9158 electric furnace, 220 volts, 15 amp., 3.3 kw., 1,800 deg.
1915 Homo electric furnace, 220 volts, 90.8 amp., 20 kw. 1,200 deg.
1918 Brown & Sharpe No. 4-A Universal milling machine
1919 Hisey-Wolf double-end dry grinder
1920 Brown & Sharpe No. 3-B milling machine
1921 Van Norman No. 3 milling machine
1922 Brown & Sharpe No. 2-A milling machine
1923 Brown & Sharpe No. 2 milling machine
1924 Pratt & Whitney vertical shaper
1926 Colburn D-4 24-in. drill press
1927 Gould & Eberhardt 24-in. shaper
1928 Ohio 20-in. shaper
1929 Gould & Eberhardt 14-in. shaper
1930 Champion 20-in. drill
1931 Barnes 20-in. column drill
1932 Gibbs "Little" drill press
1933 Davis No. 1 keyseater
1934 Pratt & Whitney 5-in. milling machine
1935 Campbell No. 2 nibbling machine
1936 Racine No. 20-CX shear-cut saw
1937 Whiton 6-in. two-spindle centering machine
1938 Jones No. 4½ arbor and straightening press
1939, 1944 Pratt & Whitney 16-in. Model B lathes
1940 Hendey 16-in. tool-room lathe
1941, 1942 Lodge & Shipley 18-in. engine lathes
1943 Hendey 16-in. engine lathe
1945 Warner & Swasey No. 1-A turret lathe
1946 Ingersoll milling-cutter grinder
1947 Brown & Sharpe No. 2 grinding machine
1948 Brown & Sharpe No. 3 grinding machine
1949 Landis No. 4 Universal grinder
1950 Landis die grinder
1951 Abrasive No. 33 vertical surface grinding machine
1952 Cincinnati 1½-in. plain cutter and tool grinder
1953 Brown & Sharpe No. 13 tool grinder
1954, 1956, 1960 Hisey-Wolf double-end dry grinders
1955 Pratt & Whitney No. 3 bench lathe
1957 Sellers No. 2-A drill grinder
1958 Sellers 3-in. drill pointing machine
1959 Oliver No. 51 3-in. drill grinder
1961 Sellers No. 1-A tool grinder
1962 Sellers No. 1 Universal tool grinder and shaper
1963 Bridgeport No. 5-F grinder
1964 Gisholt Universal tool grinder

GROUP 20—Machine Tool Repair Group

2001 Betts 54-in. by 14-ft. planer
2002 Racine No. 2-C power hack saw
2003 Betts-Bridgeford 30-in. geared-head engine lathe
2004 American 18-in. engine lathe
2005 Hisey-Wolf double-end dry grinder
2006 American 14-in. engine lathe
2007 Whiton 6-in. 2-spindle centering machine
2008 Edlund round-column drilling machine
2009 American 5-ft. plain radial drill
2010 Ohio 24-in. Dreadnaught shaper
2011 Bridgeport No. 5 tool grinder
2012, 2013 20-ft. 4,000-lb. jib cranes; 1-ton American "Lo-hed" electric hoists

GROUP 22—Tin and Jacket Work

2201 Pels double-end punch and shear
2202 Atkins 12-in. by 4-in. metal band saw
2203 Rockwell 21-in. drill press
2204 Hisey-Wolf double-end dry grinder
2205 Thomson spot welder
2206 Peck, Stow & Wilcox 98-in. cornice brake
2207 Niagara 96-in. squaring shears
2208 Peck, Stow & Wilcox 32-in. squaring shears
2209 Peck, Stow & Wilcox 36-in. by 36-ft. shear
2210 Lenox throatless rotary shear
2211 Dreis & Krump 96-in. cornice brake
2212 Thomson spot welder
2213 Niagara No. 7 geared press
2214 Peck, Stow & Wilcox 42-in. No. 142 shear
2215 Peck, Stow & Wilcox 36-in. No. 137-C shear
2216 Niagara No. 4 geared press
2217 Niagara No. 101 press

GROUP 24—Pipe Work

2401 Landis 8-in. single-head pipe threading and cutting machine
2402 Peters 12-in. abrasive pipe cutter
2403 Murchey 4-in. pipe cutter
2404 Bignall & Keller No. 3 pipe cutter
2405, 2406 Landis 1¼-in. double-head pipe and nipple threading machines
2407, 2408 Landis 2-in. double-head pipe and nipple threading machines
2409 Williams 4-in. single-head pipe and nipple threading machine
2410 3-in. extra-heavy rotary pipe bending machine
2411, 2414 Pipe forges
2412, 2415 Quenching tanks
2413, 2416 Pipe bending tables
2418, 2422 18-ft. jib cranes, 4,000-lb. capacity; 1-ton electric hoists
2419, 2420, 2421 Babbitt furnaces

GROUP 25—Physical Testing Laboratory

2501 Southwark 5¼-in. by 1¼-in. by 2-in. hand pump
2502 Ingersoll-Rand Type 15 motor-driven air compressor
2503 Southwark 1,000,000-lb. Universal testing machine
2504 Scott horizontal fabric tester
2505 Hisey-Wolf double-end dry grinder
2506 Southwark 60,000-lb. testing machine
2507 Edlund round-column drilling machine
2508 20-ft., 4,000-lb. capacity jib crane; 1-ton American "Lo-hed" electric hoist

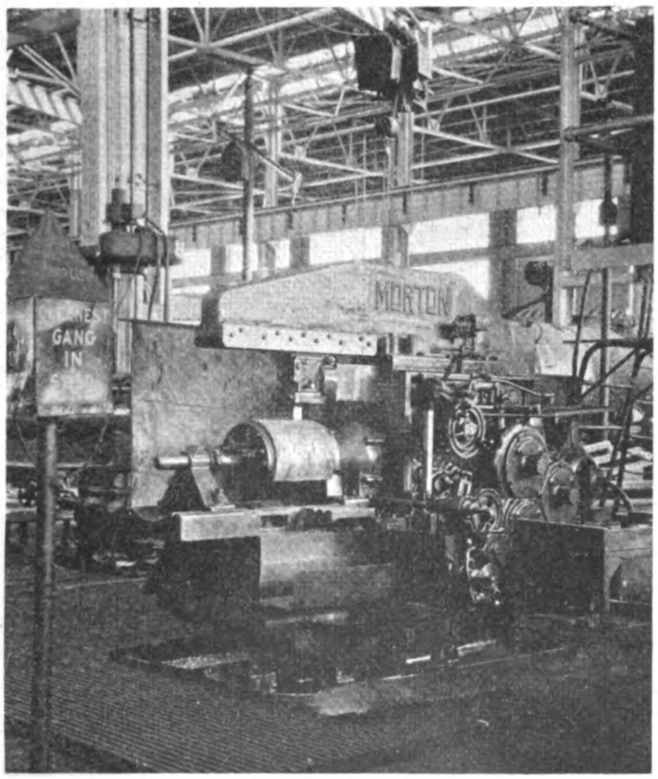
GROUP 26—Chemical Laboratory

2601, 2602 Edlund 3-D drilling machines
2603 Wicaco oil groover

Blacksmith Shop *

1 42-in. cold-saw cutting-off machine
1 18-in. double-end dry grinder
1 No. 5 wet tool grinder
1 Pneumatic stock bender
1 1,000-ton hydraulic forging press
1 Walter Stock adjusting machine
1 8-ft. 6-in. by 15-ft. car bottom annealing furnace
1 7-ft. by 9-ft. 6-in. double-chamber hammer furnace
3 3-ft. by 5-ft. furnaces
4 2-ft. by 3-ft. furnaces
1 2-ft. by 4-ft. furnace
1 5-ft. by 6-ft. furnace
3 100-lb. helve hammers
1 4,000-lb. steam hammer
2 2,000-lb. steam hammers
1 1,100-lb. steam hammer
23 Coal forges
2 Oil forges
1 1,000-amp., 75-kw., motor-generator set
1 No. 4 Oxygraph cutting machine

* The locations of these facilities are not shown on the drawings.



Machining driving-box brasses on draw-cut shapers

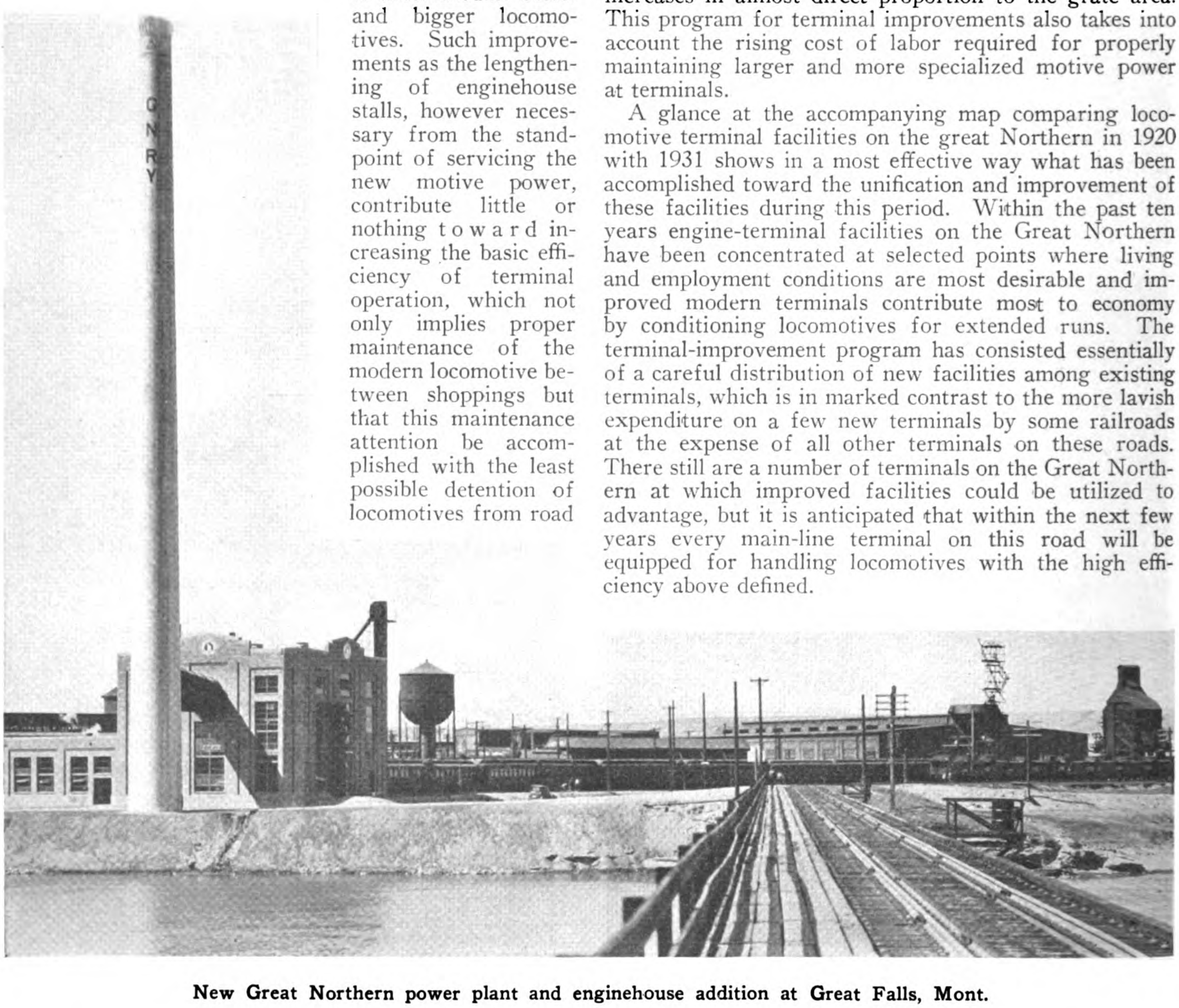
Modernizing Locomotive Terminals On the Great Northern

Main line power handled at 18 fewer enginehouses than in 1920 —Improvements at present terminals show substantial savings

PARALLELING the advent of more modern locomotives, extended locomotive runs, use of less expensive fuel and other desirable motive power developments, there must be a corresponding modernization in locomotive terminal facilities to realize the full benefit from these improvements in motive-power practice. While some roads have allowed their terminal facilities to lag seriously behind development of the locomotive, there have been many notable exceptions in the form of new terminals constructed in the last few years to meet changing motive-power conditions. But no railroad has adopted a more comprehensive or consistent program in respect to locomotive terminal improvements than the Great Northern.

An outstanding feature of the Great Northern's locomotive terminal program is the fact that it is not confined to a mere enlargement or multiplication of existing facilities required to accommodate better and bigger locomotives. Such improvements as the lengthening of enginehouse stalls, however necessary from the standpoint of servicing the new motive power, contribute little or nothing toward increasing the basic efficiency of terminal operation, which not only implies proper maintenance of the modern locomotive between shoppings but that this maintenance attention be accomplished with the least possible detention of locomotives from road service and with the lowest possible fuel and labor cost at terminals. The program for terminal improvements on the Great Northern has taken into account the opportunity for economy in connection with the large quantities of fuel ordinarily consumed at terminals, not only for general purposes about the terminal but on locomotives while building fires or standing under steam at terminals. In this connection it should be borne in mind that the increase in grate areas with the advent of the more modern locomotives, while making for fuel economy on the road, has greatly increased the coal consumption at terminals since it has been found that this increases in almost direct proportion to the grate area. This program for terminal improvements also takes into account the rising cost of labor required for properly maintaining larger and more specialized motive power at terminals.

A glance at the accompanying map comparing locomotive terminal facilities on the great Northern in 1920 with 1931 shows in a most effective way what has been accomplished toward the unification and improvement of these facilities during this period. Within the past ten years engine-terminal facilities on the Great Northern have been concentrated at selected points where living and employment conditions are most desirable and improved modern terminals contribute most to economy by conditioning locomotives for extended runs. The terminal-improvement program has consisted essentially of a careful distribution of new facilities among existing terminals, which is in marked contrast to the more lavish expenditure on a few new terminals by some railroads at the expense of all other terminals on these roads. There still are a number of terminals on the Great Northern at which improved facilities could be utilized to advantage, but it is anticipated that within the next few years every main-line terminal on this road will be equipped for handling locomotives with the high efficiency above defined.



New Great Northern power plant and enginehouse addition at Great Falls, Mont.

All expenditures for these improvements on the Great Northern have been directed in accordance with a general plan for the elimination of any terminals that could be dispensed with by an extension of locomotive runs or consolidation of facilities. Other terminals have been improved to incorporate modern features of construction and layout, a striking example being the new Interbay locomotive terminal at Seattle, Wash., where all shop facilities on the west coast are concentrated. This is a 24-stall enginehouse with a power plant containing two oil-fired 250-hp. Babcock & Wilcox bent-tube boilers, supplying direct steam to all locomotives. No fires are lighted while locomotives are in the house and no heating system or smoke jacks are required on this account. As an indication of the fuel economy resulting from this method of operating the terminal, it is observed that expenditure for all fuel oil consumed has averaged about $2.15 per locomotive turned, the shop and other general steam requirements outside the enginehouse being estimated at approximately one-half of the total boiler output.

The Interbay terminal illustrates a type of construction which has been developed as a standard for all new structures or additions to present main-line enginehouses on the Great Northern. This comprises a monitor roof of timber construction supported on 10-in. by 10-in. timber posts. Monitor sash are wood but the outer and end walls have steel sash which were found practicable owing to elimination of all smoke and stack gases in the house. This, together with an interior coating of aluminum paint, produce an exceptionally well lighted interior. The outside, end and partition walls in these new standard enginehouses are of brick. Locomotive doors are wood with steel framework hinged on cast-iron pillars. At Interbay, a wood floor was laid on account of the low cost of timber on the coast but in all other new houses and in a number of the older houses, concrete floors are being laid. The stall length of these new enginehouse sections varies with the requirements for size of locomotives to be handled, but this does not alter the general type of construction. At Interbay, the stall length is 116 ft. and in the new addition to the enginehouse at Great Falls, Mont., and other main line terminals, the stall length is 134 ft. as shown in the accompanying cross-sectional drawing.

While the gradual extension of locomotive runs has been a determining factor in the rearrangement of locomotive terminals, the substitution of coal for oil fuel and utilization of low priced coal mined locally, are now equally important factors in respect to the rehabilitation of these terminals. The increased use of coal on locomotives has added a considerable burden to terminal operations, not only in respect to coal handling but cinder disposal, since the available western coals have a high ash content. During the past ten years the Great Northern has built seven steel coaling stations. A majority of these new coaling plants have been erected to supersede frame coaling stations which, although mechanically operated, had become expensive to maintain and inadequate in capacity. At the larger terminals the practice is to install all-steel superstructures of 500 tons overhead bin storage and a hoisting capacity of 75 tons per hour. This is obtained with balanced buckets and a mechanically reversing hoist driven by a 15-hp. motor, the low current consumption required for this type of equipment being one of the factors contributing to the operating savings obtained from improved coaling facilities.

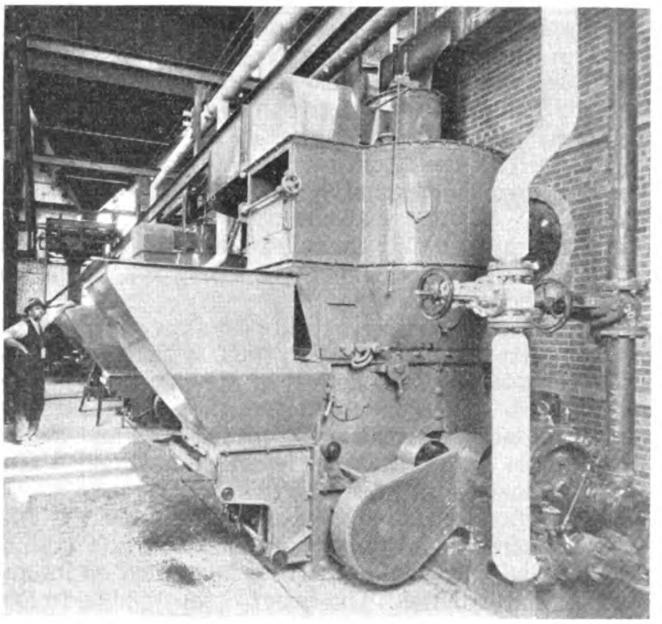
It has been found on the Great Northern that coaling stations of this type with the steel superstructure can be built more economically than with concrete and, if necessary, can be moved from one terminal location to another to meet a change in operating conditions.

Originally all locomotive cinder-handling facilities on the Great Northern were of the familiar hand shovel type with a depressed track for the cinder cars into which the ashes were shoveled. There are now seven locomotive terminals on the Great Northern having mechanical equipment for handling cinders. Most of these facilities are designed to serve several locomotive tracks, every multi-track unit being equipped with cast-iron hoppers of 100 cu. ft. capacity and undercut gates between adjacent tracks served and a bucket of 50 cu. ft. capacity running under these hoppers. The ash bucket is entirely automatic in its operation, being controlled by electric push-button switches between the tracks so that the same men who dump locomotive fires and empty the ash pans can hoist these cinders into an adjacent car without additional labor. The labor savings accomplished by each of these mechanical cinder plants depends on the number of tracks served and locomotives handled, but for a typical three-track installation is averaging $4,000 per year. There is also an indirect saving accomplished in reduced detention to locomotives passing over a multi-track cinder plant into the enginehouse because of the increased number of locomotives that can be accommodated at the same time.

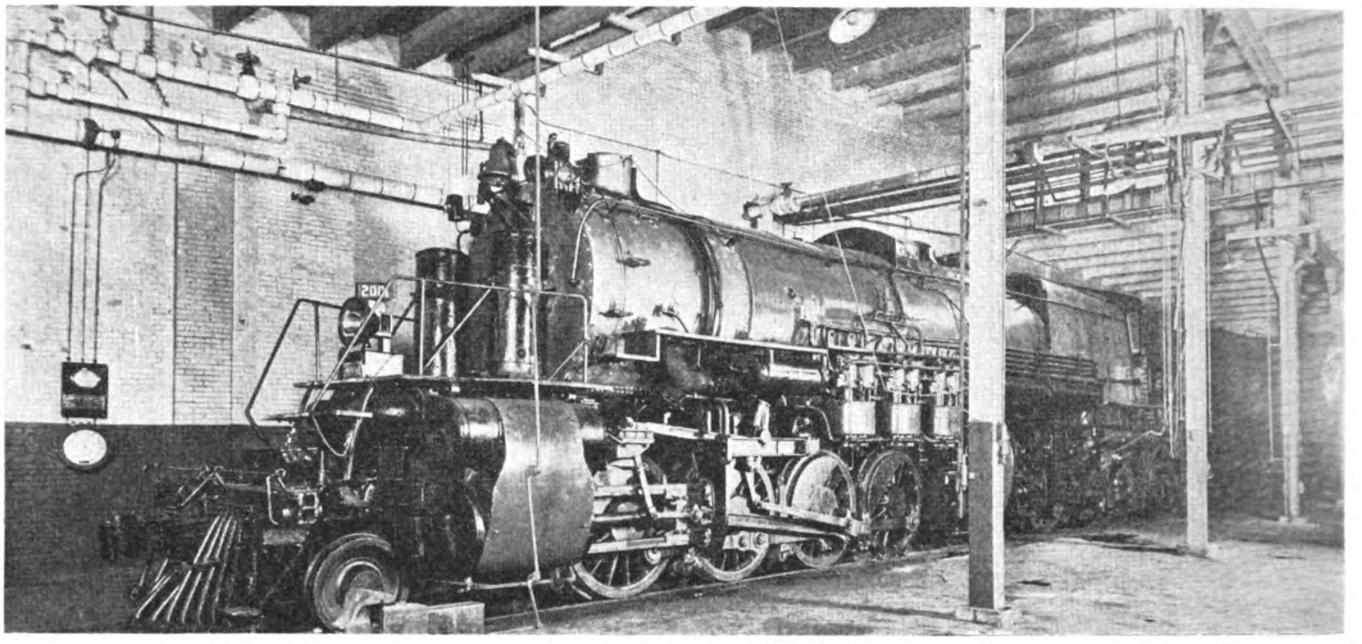
Improved Boiler Plants an Important Objective

Ten years ago the power plants at locomotive terminal on the Great Northern had stationary boiler equipment consisting very largely of old locomotive or horizontal return-tubular boilers of limited capacity. They were probably no worse than on many other roads where there was little or no appreciation of the large quantities of fuel usually wasted by these antiquated facilities, or of the handicap to satisfactory terminal operation because of their inadequate capacity.

In recent years some roads have undertaken to improve this situation by the electrification of terminals. This has involved the installation of motor-driven compressors and other shop tools where required and electric stack-blower fans in place of the usual steam blower line. Electric current rates that on their face appear attractive are usually offered by the public utility com-

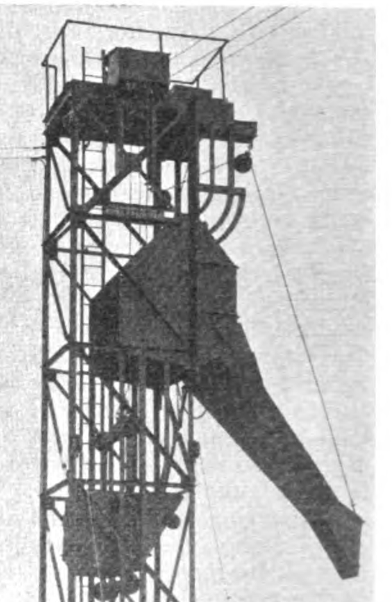


Unit pulverizers adapted to burning low-cost screened coal in Great Northern locomotive terminal power plants



pany as an inducement but often prove expensive for the railroads on account of certain premiums that must be paid for peak-load requirements. Furthermore, at all terminals on the Great Northern the heating load is an important consideration, as heat, not only in the enginehouse but for adjacent shop and station buildings, coach yards, etc., is required for at least nine months of the year. To make an investment in electrically operated equipment and purchase current throughout the entire year in order to close down and disrupt the organization of a stationary boiler plant for a few months was not considered economical, particularly where the opportunity exists, as on this road, to purchase locally mined coal suitable for stationary boiler use at a low price. The policy on the Great Northern is to take advantage of this situation through improved power plants.

Typical interior of new standard enginehouse construction on Great Northern showing high pressure locomotive steam supply line from power plant with meter and low pressure connections



Multi-track mechanical cinder plant at the Williston (N.D.) terminal, typical of several installations that are making a substantial labor saving and expediting locomotive handling

The first important step in this direction on the Great Northern was the construction several years ago of a new boiler plant at Minot, N. D., designed to utilize the lignite coal that is mined locally. This plant consists of three Edgemoor boilers of 250 hp. capacity each, with chain-grate stokers and forced draft. Originally this plant was intended to furnish steam at 150 lb. pressure for the operation of an engine-generator set as well as the steam required for drafting engines in the enginehouse and heating all of the terminal buildings. About a year ago however, the boiler pressure was raised to 175 lb. and a direct steaming system installed to serve 18 stalls, comprising the newer section of the enginehouse.

All of the larger freight and passenger power turned at Minot is now operated by this system, locomotive fires being dropped on arrival at the cinder pit and not ignited until the locomotive leaves the enginehouse. All steam required for resteaming locomotives and holding them under steam awaiting departure is supplied from the stationary boiler plant. The greatest economy in the operation of this system at Minot is derived from the difference in stationary power-plant fuel and the cost of coal that would otherwise be burned on locomotives at the terminal. The eastern coal supplied to locomotives at this point costs about $3.75 per ton at Superior, Wis., and must be hauled nearly 500 miles to Minot, while lignite coal burned in the stationary boilers costs 75 cents a ton at the mines which are less than 75 miles from Minot. While this lignite coal is inferior in heat value to the locomotive coal, the stationary boilers in which it is burned are operated at a much higher rate of efficiency than could possibly be obtained on locomotives standing in the enginehouse so that this difference in the cost of fuel per ton represents approximately the actual saving for each locomotive turned. In addition to this saving, there is an appreciable reduction in the amount of fuel required to heat

the enginehouse because of the elimination of open smoke jacks through which a considerable amount of heat escapes in cold weather.

New Power Plants Typify Best Modern Construction

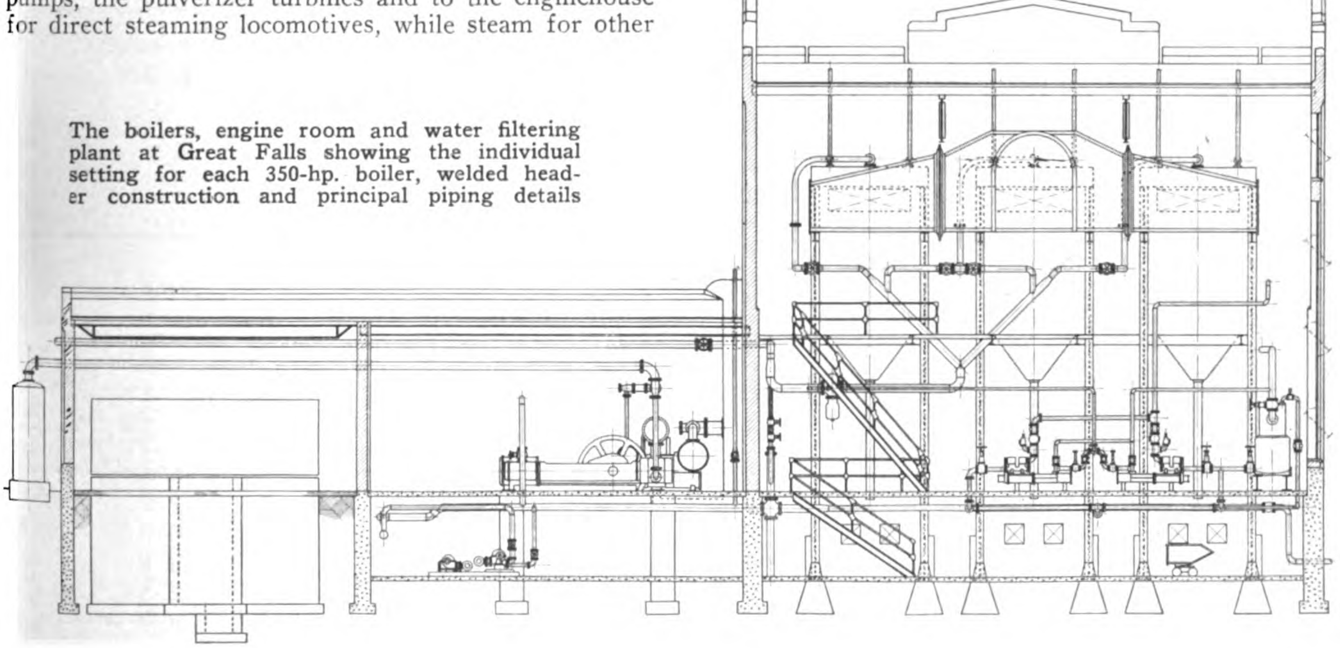
This year the Great Northern is building three modern power plants, at terminals where cheap stationary power-plant coal is available, to replace horizontal return-tubular and old locomotive boilers in which it has been necessary to burn fuel oil to develop the required output. While the highest standards of boiler efficiency have been aimed at the capital expenditures involved have been moderate. The largest of these power plants has just been completed at Great Falls, Mont., to serve a 36-stall enginehouse, the adjacent locomotive and car shops and to furnish steam for heating these buildings as well as the passenger station, freight depot and division offices at some distance (across the Missouri River bridge) from the locomotive terminal. Steam-driven equipment in the power house includes an air compressor, turbine pumps for a water filtering plant, duplex boiler feed pumps (outside packed) and turbine-driven unit coal pulverizers for supplying the boilers with pulverized coal. No electric generating equipment is provided as the electric current requirements are purchased under contract from near-by hydro-electric plants. For supplying the steam required at this terminal, the new power plant is equipped with three 350-hp. Bros-Wetherbee boilers designed to burn pulverized coal from Strong-Scott unit pulverizers. The boilers each have individual settings with Liptak air-cooled walls and a combustion space ample for developing over 300 per cent rating.

Natural draft sufficient for developing this rating from two boilers in operation at the same time is provided by a 225-ft. concrete stack. Instruments for governing the efficient operation of each boiler include a Republic integrating and recording steam flow meter with CO_2 and stack-gas temperature recording on a single chart, with a set of draft gauges mounted on the same panel. The stack damper control on each boiler is of the automatic type manufactured by the Engineer Company. The boilers have Marion soot blowers with seven blower heads to each boiler. The power-plant piping involves two pressure systems, the boilers carrying 250 lb. supply steam at this pressure direct to the boiler feed pumps, the pulverizer turbines and to the enginehouse for direct steaming locomotives, while steam for other auxiliaries, heating, etc. is taken from a low-pressure header supplied through the reducing valve arrangement illustrated herewith. The accompanying cross-sectional and elevation drawings of the power plant and boilers show the general arrangement and construction of this equipment, particularly the design of boilers and principal piping details. This is of all welded construction with a special header arrangement for equalizing steam flow from each boiler. All steel fittings with welded-in necks and welded-in elbows were employed in this construction, which was installed by the Railway Engineering Equipment Company. All valves, except the Fisher pressure-reducing valves and a Hancock cast steel cone-seated valve in the pressure-reducing by-pass, were furnished by the Crane Company, Series 30XN cast-steel valves being employed in the higher-pressure steam mains and boiler feed lines. The coal- and ash-handling facilities are both of the vertical-conveyor type, with a 125-ton coal storage bin in the boiler room. A motor-operated weigh-lorry distributes coal from this bin to each of the three unit pulverizers.

Fuel Cost Reduced at One Terminal from $5,000 to $1,500 a Month

This new power plant supersedes an old boiler plant typical of many terminal installations still in use, comprising three horizontal return-tubular boilers of 150-hp. capacity each and five locomotive boilers, all oil-fired and consuming fuel oil at the average rate of about 1,400 lb. an hour. In addition to this, the new power plant supersedes a large oil-fired locomotive kept under fire in the enginehouse as a temporary expedient for supplying the steaming system pending construction of the new power plant. The total fuel oil consumption at this terminal has been costing the railroad about $5,000 per month which will now be reduced to a coal consumption of less than 50 tons per day at a price of $1.00 per ton.

The coal now being burned is mined near Great Falls by a subsidiary company. As this coal is intended for use in pulverizers it is screened out of the locomotive coal furnished to the railroad by the same company which tends to improve this coal for locomotive use. While the coal supplied is of relatively low heat value, the power plant is equipped to realize the utmost effi-



The boilers, engine room and water filtering plant at Great Falls showing the individual setting for each 350-hp. boiler, welded header construction and principal piping details

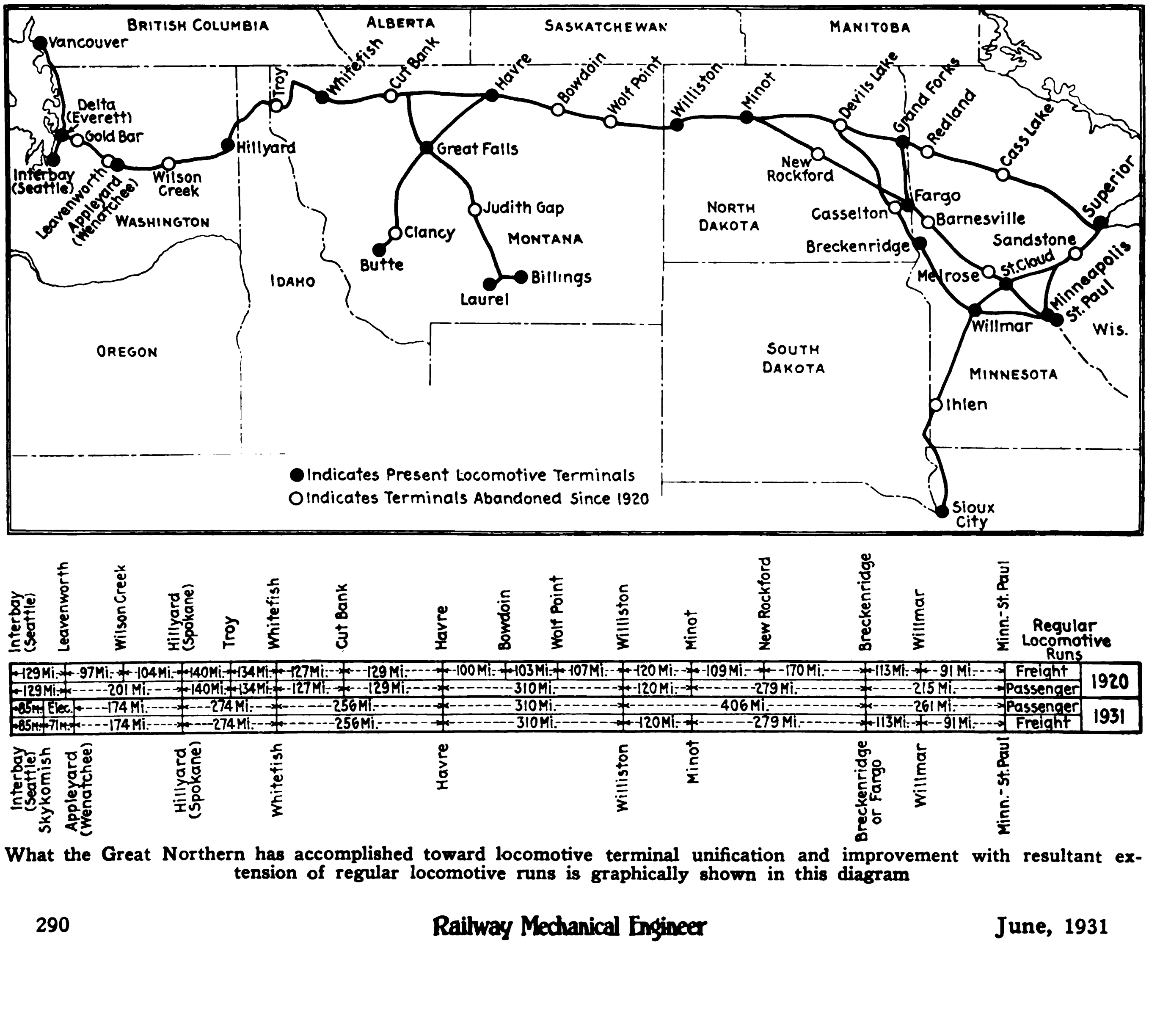
ciency from this grade of coal. In an initial run stack gas temperatures of approximately 500 deg. and a CO_2 content of more than 17 per cent were observed.

The direct-steaming system in the enginehouse to be supplied by this power plant with steam at 250-lb. pressure, extends over 18 stalls which includes an 8-stall addition of the new standard construction without smoke jacks and ten adjoining stalls which are sufficient for handling all of the larger locomotives turned at this terminal. A Cochrane indicating, recording and integrating flow meter is installed in the direct-steam supply line where this enters the enginehouse as a guide in the operation of this system to avoid unnecessary peak loads and record the total steam used. The entire power plant project at Great Falls cost the railroad less than $200,000, exclusive of the equipment already on hand, such as air compressors, etc., which were utilized.

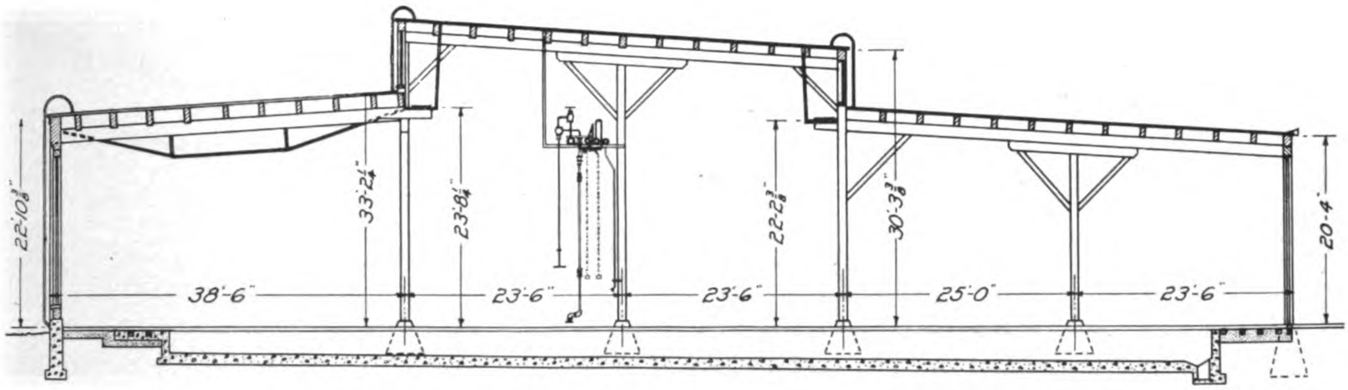
Two other locomotive-terminal power plants now under construction on the Great Northern are located at Whitefish, Mont., and Williston, N. D. Both of these plants conform to the same high standard of design and construction as that above described, although they are of smaller capacity than the Great Falls power plant. At the Whitefish terminal, three boilers of 250 hp. capacity each, furnished by the Puget Sound Machinery Depot, are being installed. These are designed for burning pulverized coal and are of the same type of construction as that employed at Great Falls, which will permit operation at 300 per cent rating with the same degree of efficiency. Screened coal from the Great Falls district will also be utilized, but at a somewhat higher cost on account of the longer freight haul involved. However, this coal will move against the direction of heavy tonnage so that its actual cost to the railroad will be small in comparison with oil fuel now used at this terminal. There are no shops at Whitefish and auxiliary steam-driven equipment is considerably less than at Great Falls so that the principal economy to be derived from the efficient utilization of this low cost coal will be obtained by means of the direct steaming system in the enginehouse. This system embraces 21 stalls including a 7-stall addition of the new standard section 134 ft. long.

As all of the passenger locomotives, and main line freight power now operating out of the Whitefish terminal are burning oil costing over $1.00 per barrel, the economy of utilizing cheap coal burned under the most efficient conditions in place of the oil fuel that would otherwise be burned on locomotives at a less efficient rate of evaporation, is obvious. In addition to this economy, the heating load in winter will not only be reduced by closing all smoke jacks in the direct steaming section of the enginehouse but as this has been one of the principal demands on the present oil-fired boilers, such steam as will be still required for heating purposes can be supplied at a much lower cost per pound.

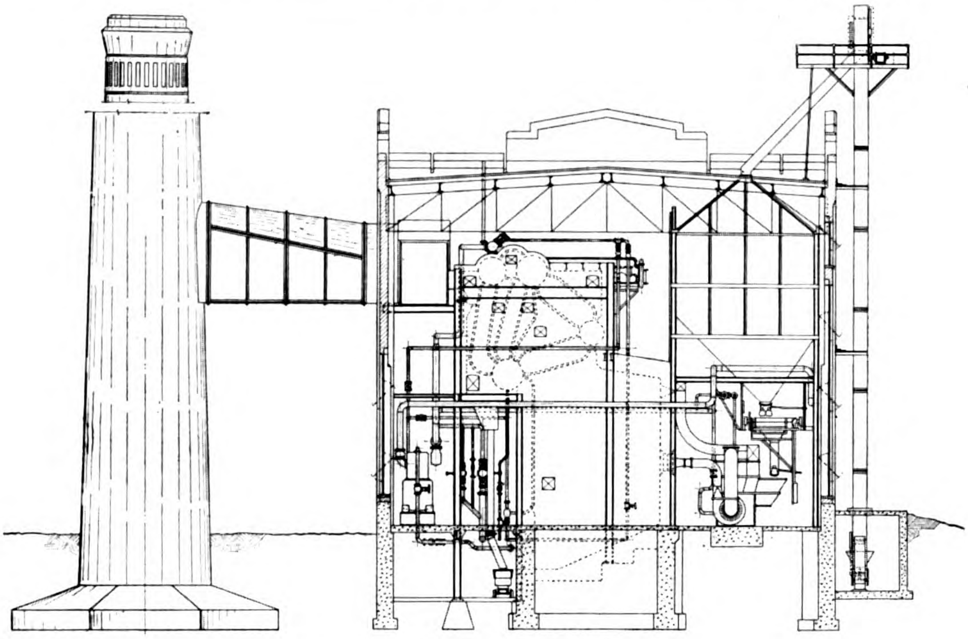
The new power plant at Williston, N. D., while having the same rated capacity as Whitefish, is of quite different construction, being equipped with three Edgemoor straight-tube boilers and chain-grate stokers. These stokers, however, will each have a forced-draft fan and the combustion space below the flues, width of



What the Great Northern has accomplished toward locomotive terminal unification and improvement with resultant extension of regular locomotive runs is graphically shown in this diagram



Cross section of typical new standard Great Northern enginehouse construction with combined blow-down, filling and steaming connections to locomotive shown



Cross section of Great Falls power plant showing coal handling arrangement and ample combustion chamber with water tube back and air-cooled walls discharging heated air in the duct to the unit pulverizers

stoker, etc., are of ample dimensions for developing a 200 per cent rating either with screening from the Montana mines or with lignite coal. The lignite, if used, would be of the same grade as now utilized at the Minot terminal. In either case the cost of coal to be utilized in the new power plant will be relatively low compared with either eastern coal or oil fuel. The number of enginehouse stalls equipped for direct steaming locomotives at this terminal will be 19, which is sufficient for handling the larger motive power in active service.

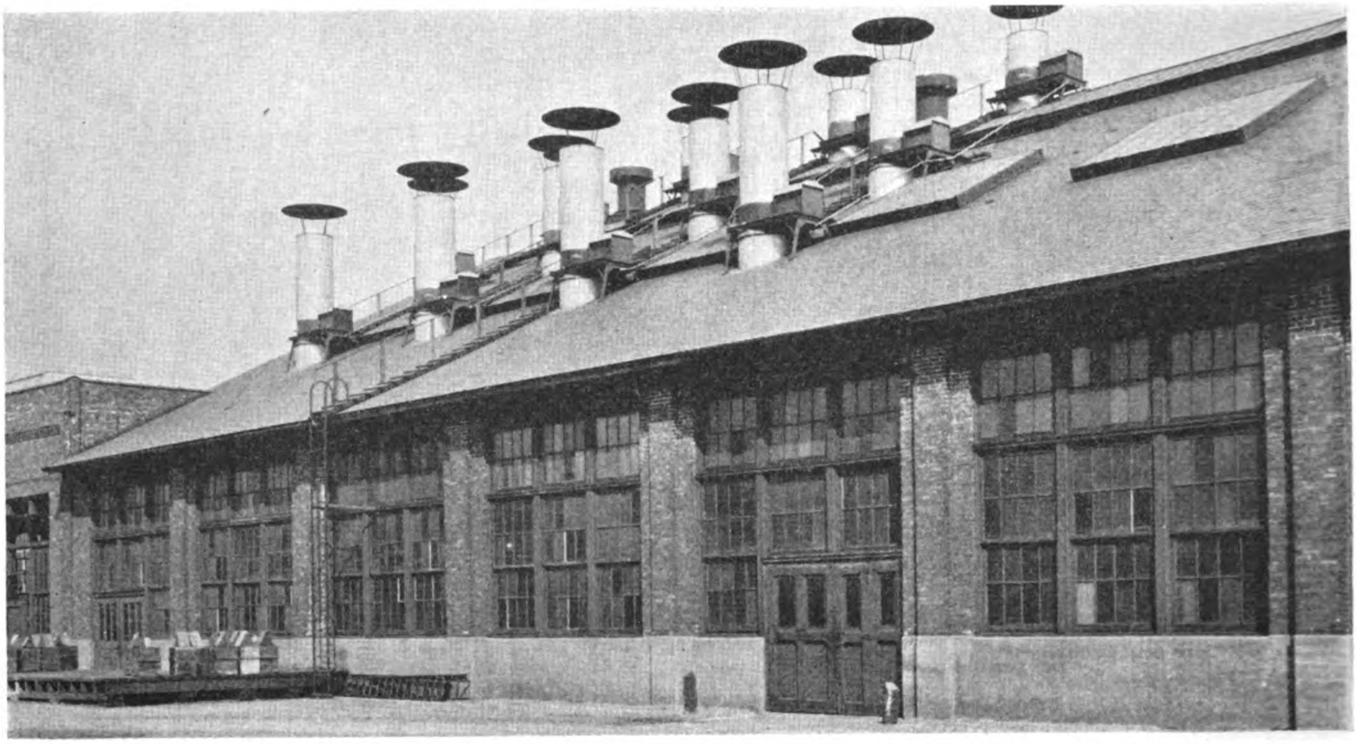
Additions in Main-Line Engine-Terminal Facilities Since 1920

	1920			1931				
Location	No. stalls	Coaling station	Hot water wash and fill	No. stalls	Coaling station	Hot water wash and fill	Direct steam	Mech'l cinder plant
Interbay (Seattle)	20	....	....	24	....	Yes	Yes	....
Appleyard (Wenatchee)	3	....	....	24	250 tons Timber	Yes	....	....
Hillyard	28	500 tons Timber	....	34	500 tons Timber	Yes	....	....
Whitefish	30	100 tons Incline	....	37	500 tons Steel	Yes	Yes	....
Great Falls	36	500 tons Timber	....	38	500 tons Steel	Yes	Yes	3 tracks
Havre	31	300 tons Timber	Yes	30	500 tons Steel	Yes	....	....
Glasgow (between Bowdoin and Wolf Point)		No terminal			No terminal			2 tracks for cleaning fires on through runs
Williston	30	274 tons Incline	....	32	500 tons Steel	Yes	Yes	4 tracks
Minot	36	400 tons Timber	....	38	400 tons Timber	Yes	Yes	....
Grand Forks	20	500 tons Timber	....	38	500 tons Timber	Yes	....	2 tracks
Fargo	..	....	....	16	150 tons Timber	....	....	....
Breckenridge	31	250 tons Incline	Yes	32	250 tons Incline	Yes	....	....
Wilmar	36	200 tons Incline	....	36	500 tons Steel	Yes	....	....
St. Cloud	5	500 tons Incline	....	24	500 tons Incline	Yes	....	....
Minneapolis	25	120 tons Incline	....	34	500 tons Steel	Yes	....	....
St. Paul	47	400 tons Timber	....	25	500 tons Steel	Yes	....	....
Superior	33	250 tons Incline	....	33	250 tons Incline	Yes	....	....

Improvements at Small Terminals

In addition to the more important terminal improvements above described, a host of less spectacular but no less sound improvements have been accomplished at locomotive terminals on the Great Northern during the past ten years. At a number of smaller terminals where eastern coal is burned, the power-plant situation has been improved in various ways. For instance, at the Willmar (Minn.) terminal the stationary boilers have been equipped with Strong Scott unit pulverizers, motor-driven, which has not only increased their capacity to the desired output, but has greatly improved the efficiency of this terminal.

(Concluded on page 302)



Exhaust stack arrangement for four DeVilbiss canopy-type car exhausts installed at the Milwaukee passenger-car paint shop

Passenger-Car Spray Painting At Milwaukee Shops

Canopy-type exhaust hoods effect an actual pay-roll saving of $12,000 to $15,000 per annum

"THE greatest single labor-saving device installed in recent years" is the description accorded the four canopy-type exhaust hoods now used in spray painting passenger train cars at the Milwaukee (Wis.) shops of the Chicago, Milwaukee, St. Paul & Pacific. When this equipment, furnished by the DeVilbiss Company, Toledo, Ohio, was installed in March, 1930, at a complete installation cost, including material, labor, changes in floor construction, heating system, sprinkler equipment, etc., of $37,342, a possible saving of $9,300 annually in labor was estimated. The actual pay-roll saving made as of March 17, 1931, due to the use of the spray hoods, was $59.07 per working day, or $12,286.56 yearly, for 52 weeks at four days each, or $15,358.20 yearly for 52 weeks at five days each. The details of how this saving was made are shown in Table I, which indicates a potential pay-roll saving of $3,000 to $6,000 greater than the estimated saving (depending on the number of working days in the year).

The stationary canopy-type exhaust hoods, illustrated, were installed on four tracks in one end of building No. 24 at the Milwaukee passenger-car shops. The canopies are constructed of heavy-gage sheet metal which is spot-welded to angle-iron frames. Heavy-gage galvanized sheet metal is used in the stacks and caps, the stacks being guyed to the roof with cable and turnbuckles.

The multi-blade fans are 42 in. in diameter and are driven by 5-hp. Allis-Chalmers motors through V-belts. The motors and fans are ball-bearing and require little attention. Fan blades are of aluminum and are mounted on the roof with a housing over the motors and belts. Motors and fans are mounted on a frame, making a complete unit, which, in turn, rests on legs bolted to the roof. Each fan has a capacity of 18,000 cu. ft. per min., and five are used on each canopy. Each canopy is 85 ft. long, giving a fan spacing of 17 ft.

Six Benjamin, 300-watt, vapor-proof lights are used on both sides of the canopy, spaced approximately 6 ft. apart. These are controlled by switches in groups of four, allowing the operator to use only the lights where he is spraying.

A double set of Grinnell sprinklers are used, one set for the canopy and one hanging under the inner canopy to protect the work. The heads are silica-bulb, two rows on top and two rows on the bottom, spaced 6 ft. apart.

A Buffalo pressure blower, driven by a 5-hp. motor, is located on the beams above the canopy, forcing air down through a duct to the concrete floor ducts. These are 12 in. wide and 23 in. deep with walls approximately 6 in. thick. Sufficient air pressure is maintained to force air upward through the floor slots past the sides of the car at velocities up to 500 ft. per min., as required.

In action, the blower air forms a curtain between the operator and the work. This prevents any rebound of spray, since the air stream is close to the side of the car and the operator sprays through the stream. The air starts the fumes upward, carrying them up to the canopy,

thus combining a push from the blower with a pull from above.

Referring to the drawing, the action of this system is clearly illustrated at the left for exterior spray painting. An air current, indicated by the arrows, flows from the floor slots upward between the painter and the car side, the spray-gun nozzle passing through this air curtain, which protects the spray operator from all fumes. These are carried instantly into the lower opening of the canopy and from there to the exhaust pipe and the atmosphere under the action of the powerful motor-driven fan. For painting a car interior, as shown at the center in the illustration, the input air from the floor slot is deflected into the car at the windows by the deflector fin *A*, the hinged section *B* being closed. The air stream, as deflected by this fin, flows through the interior of the car and out through opposite side windows, there joining air from the floor slot on that side of the car and being exhausted through the stack, as indicated.

Direct ventilation is provided for spray painting car roofs by opening the hinged sections *C* and closing sections *B*, as shown at the right in the illustration. The input air from the floor slots is passed over the car roof, upward into the canopy through the opening and then directly through the stack to the open air.

The weight of each canopy with the fans, motors, stacks, etc., that would be carried on the building is approximately 30,000 lb., but as this is spread over a space nearly 20 ft. wide and 85 ft. long, no reinforcing of the building was necessary.

The purpose of canopy-type exhaust hoods in the Milwaukee passenger-car shop is to permit the spray painting of equipment without attendant fire and health hazards, and the entire design, construction and installation have received the approval of the Underwriters and the State Health and Labor Departments.

Spraying Force vs. Brushing Force

The present spray-booth force at Milwaukee shops (as of March 17, 1931) was built up by the assignment of three sprayers from the former night spraying force, the transferring of two sprayers from the sash and door spraying force, and the hiring of three new expert sprayers. An expert main sprayer, capable of supervising and instructing others, was also hired. The tractor driver is a former night sprayer, and the three helpers are painters' helpers or washers transferred to the spray booths. Of the 13 men involved, nine are former employees transferred to the booths and four are men hired new.

A comparison of the former painting and spraying force with the present spraying force (Table I) shows that only three additional sprayers were added to offset 15 painters laid off. This means that paint can be applied on a car about five times quicker by spraying than by brushing, a conclusion further borne out by the fact (established by time studies) that a 70-ft. coach, for example, can be varnished by spray in about two hours, whereas 10 hours were allowed for brushing.

Former Painting Method—Assigned Car Output of Booths

Prior to the operation of the spray booths, most of the so-called rough painting work on the cars (roof, bottom, trucks, etc.) was sprayed either in the shop at night or in the shop yard during the day. The finer work, such as colors and varnishes, was brushed. Since the operation of the spray booths, it may be said that both the rough and finer work is now sprayed. The present exception is certain interior work on sleepers, etc., which is still brushed. Cars are, of course, still puttied, sanded, primed and touched up by hand.

The outside lettering on cars (except the gold leaf) is now sprayed instead of brushed. However, this work is not done under the spray canopies and has no connection with them and is, therefore, not covered in this study.

To obtain an output of three cars a day from the coach shops, it is necessary for the spray booths to handle 12 cars a day; that is, apply three first-coat body colors, three second-coat body colors, three first-coat outside varnishes and three second-coat outside varnishes. The other painting work of the cars is generally divided into four parts also, and handled at the same time that the outside body coats are being applied. In other words, each car must enter the spray booths four times.

To determine the actual performance of the spray booths, a study was made of them from January 13, 1931, to February 26, inclusive, a period of 26 working days, and the results obtained from this study recorded. The study was, without doubt, slightly unfair to the spray booths, inasmuch as during that period the booths were in what might be called an experimental stage. The sprayers were learning how to handle their guns properly, how much material to apply to surfaces and how to apply it, how to get clean jobs, how to cut in, etc. The spray-booth supervision, on its part, was trying various methods of handling the work, regulating the air drafts, etc., so as to obtain the best methods and the correct spraying procedure. Furthermore, the car

Table I—Actual Pay-Roll Saving, Due to the Operation of Spray Booths, from December 15, 1930, to March 17, 1931

Labor Cost Prior to the Operation of Spray Booths (Dec. 15, 1930, and Before)

Occupation	Work	No. of men	Hourly rate	Daily cost
Painters	Brush work on cars such as colors and varnishes, etc.	15*	$.80	$96.00
Helper	Carry paint from mixing room to painters......	1	.57	4.56
Sprayers	Spray roofs, bottoms, etc., on cars at night.	3	.80	19.20
Helper	Assist night sprayers...	1	.57	4.56
Sprayer	Spray trucks in yard....	1	.80	6.40
Sprayer-blaster ..	When no sandblasting work, sprayed roofs, etc., at night........	1	.80	6.40
	Total	22 men		$137.12

* Covers the 15 painters laid off between December 15, 1930, and March 17, 1931.
** Rate of pay 90 cents per hr. plus daily extra allowance of 1/3 hr. at time and a half

Labor Cost After Operation of Spray Booths (As of March 17, 1931)

Occupation	Work	No. of men	Hourly rate	Daily cost
Main sprayer	Leadman in spray booth	1	$.90	$7.65**
Sprayers	Spray roofs, bottoms, trucks, colors, varnishes, etc., on cars in spray booths	7	.80	44.80
Sprayer-blaster ..	When no sandblasting work, sprays cars in spray booths	1	.80	6.40
Helper	Assist sprayers in spray booths	1	.57	4.56
Helper	Carry paint from mixing room to sprayers.....	1	.57	4.56
Helper	Grease and clean glass on cars handled in spray booths	1	.57	4.56
Tractor driver....	Help move cars in and out of shop and spray booths	1	.69	5.52
	Total	13 men		$78.05

output averaged only 10.54 cars per day instead of the full quota of 12, and the number of sprayers varied from five to eight per day, averaging less than seven per day for the period, as against the present force of eight sprayers.

Spray Booths Reduce Labor Costs

The spraying of cars under the canopies during the study period resulted in a reduction of 50.4 per cent in man-hours and 54.2 per cent in direct labor costs, compared with doing that same work by brush and spray prior to the operation of the spray booths. The details are given in Table II. The old performance time is based on the painting methods—part brush and part spray—used just prior to the operation of the booths, as of November 1, 1930, so as to give the booths no undue credit. Furthermore, the spray booths' performance time, confined to actual sprayers and one helper, is figured as being 8 man-hours per man per day, and thus includes all wasted time.

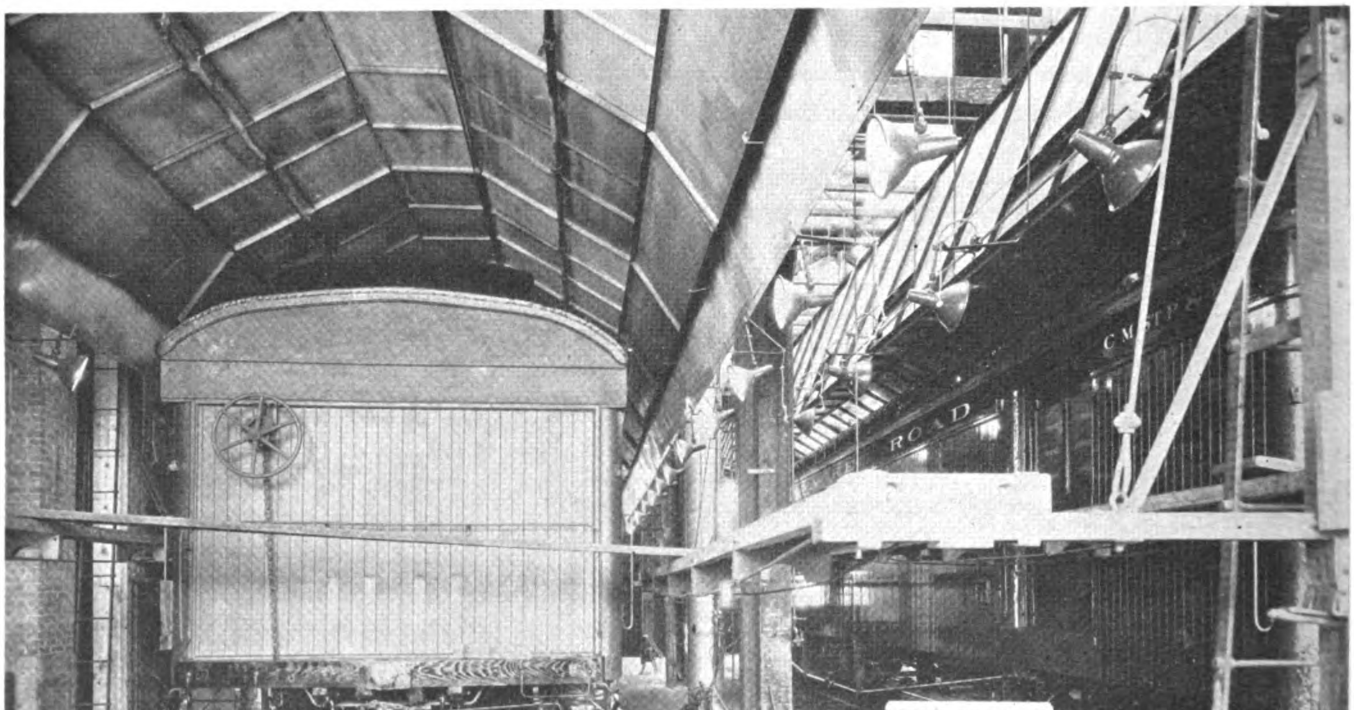
About the same percentage of saving is shown by a comparison of the former painting force with the present spraying force. Table I shows that it formerly took 15 painters, five sprayers and one helper to do the work now done by eight sprayers and one helper (the main sprayer, material carrier, glass greaser and tractor driver are excluded). This gives a 57-per cent reduction in man-hours and a 58-per cent reduction in pay-roll.

Table II—Spraying Work Done from January 13, 1931, to February 26 (26 Working Days) As Compared With Output With Former Brushing-Spraying Method

Work Turned Out During Period		Former Costs			Present Spray-Booth Costs		
Operation	No. of coats applied	Time required (man-hours)	Man-hour cost	Value of work turned out	Time required (man-hours)	Man-hour cost	Total cost of work
Color No. 1	59	520	$ .80	$ 416.00			
Color No. 2	64	507	.80	405.60			
Varnish No. 1	59	456	.80	364.80			
Varnish No. 2	63	503	.80	402.40			
Prime car body	1	16	.80	12.80			
Vestibules, two per car	40	160	.80	128.00			
Varnish woodwork	24	376	.80	300.80			
Paint ceiling, coaches, etc.	9	86	.80	68.80			
Kitchen and pantry, diners	5	40	.80	32.00			
Total of work formerly brushed	324	2,664		$2,131.20			
Bottoms	76 }	200	$10.96 day	274.00			
Roofs	73 }						
Floor, base, pipes (coaches, etc.)	38	152	.80	121.60			
Wall, ceiling, pipes (head end)	25	144	.80	115.20			
Trucks, steps, boxes, no. of cars	62	124	.80	99.20			
					1,421	$ .80	$1,136.80
Total of work formerly sprayed	274	620		$ 610.00	208	.57	118.56
Grand Total	598 jobs	3,284 man-hours		$2,741.20	1,629 man-hours		$1,255.36

(Spray booth costs given below cover all the 598 jobs turned out. Costs cover the actual sprayers and the one helper who dusted and cleaned off the cars. The costs, therefore, will compare accurately with the former brushing and spraying costs.)

The large reduction in labor costs has not resulted solely from using the spray gun instead of the brush. It is evident that the canopies have also reduced the time on jobs that were formerly sprayed before the hoods



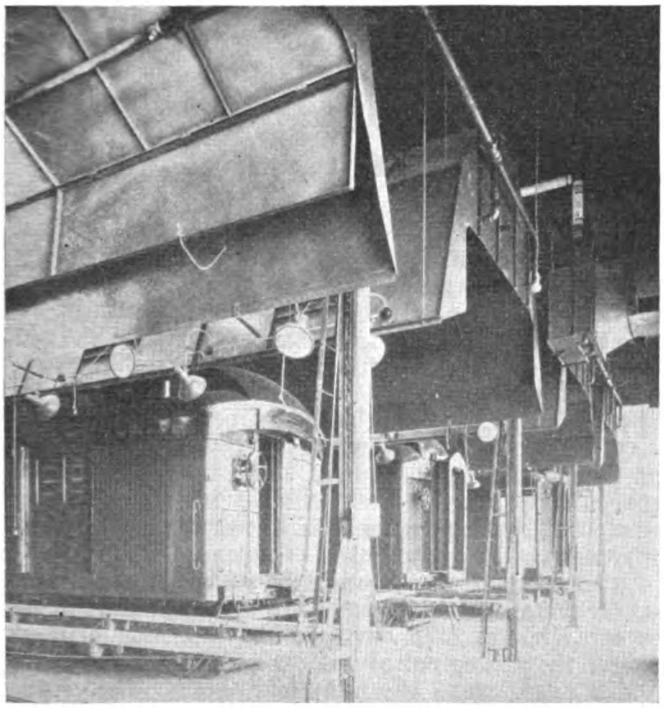
Interior of the spray hood, showing movable deflector plates, ample lighting facilities and automatic sprinkler system

were in operation. This latter reduction is undoubtedly due to the segregation of the work and the intense supervision under the hoods.

Saving in Labor Cost Per Car

The labor cost to paint a car under the former brushing-spraying method as compared with the present spraying method can be figured in three ways:

1—Based on the pay-roll (Table I), it formerly required 22 men at daily wages of $137.12 to turn out three cars a day. This is an average of $45.71 per car.



Ends of the four DeVilbiss canopy-type car exhausts installed in Milwaukee passenger-car paint shop

The present spray-booth force consists of 13 men at a daily wage of $78.05. This equals $26.02 per car. The booths, therefore, save $19.69 in labor per car turned out of the shops. This saving takes into consideration all the labor elements involved, that is, it includes the main sprayer, material carrier, glass greaser and tractor driver.

2—Confining the study to the men actually brushing and spraying (Table I), it is found that the former method required 21 men, including one helper, and cost $132.56 in wages daily, or $44.19 per car. The present spraying requires nine men, including one helper, and costs $55.76 in wages daily or $18.59 per car. The booths save $25.60 in labor per car.

3—Based on the performance time required to paint a 70-ft. car (Table IV), the former costs for passenger-carrying cars averaged $97.90 as against $68.35 for the present spray booths. This is a saving of $29.55 per car.

More Paint Material Used

During the study period, an average of 378.82 lb. of 19 different kinds of paint material, equivalent to 40.49 gal., was used daily in the spray booths. This 378.82 lb. of material was valued at $81.35. Each man sprayed an average of 55.44 lb., or 5.92 gal., of paint each eight hours.

The study shows (Table IV) that on the whole about 29 per cent more paint material is used for spraying than for brushing. However, a comparison between the present spraying and the former brushing-spraying methods shows that only about 9.8 per cent more material is now used per car. The difference between 29 per cent and 9.8 per cent is due to the fact that no more paint is consumed in spraying under the canopies than is consumed in spraying elsewhere and the increase is only on coats formerly brushed. Of the 598 jobs handled during the study period, 324 were coats formerly brushed and 274 were coats formerly sprayed.

A study of Table IV shows that, compared with brushing, the spraying resulted in 6.91 lb. more of first body color (yellow) being used per car, 2.60 lb. more of second body color (yellow) and 2.00 lb. more of exterior varnish per coat. The large increase in the amount of first body color used is undoubtedly due to the stress laid upon the necessity of building up a good paint foundation on the car. In this connection, no first colors were spotted during the study period; all were coated solid. Spotting was found to save practically no labor and produced an undesirable job.

Stress was also laid on the necessity of spraying heavy coats of paint and varnish on the cars to "drown" the dirt and to give smoother and better-appearing jobs, as well as more durable ones. In this connection, during the study period the sprayers were ordered to use the

Table III—Average Amount and Cost of Paint Materials Per 70-Ft. Car Applied by Spraying or Brushing

Paint material	No. of coats	Total length of cars, ft.	Total lb. of paint material used	Av. lb. of paint per 70-ft. car	Price of material per lb.	Av. cost of paint used on 70-ft. car	Lb. of paint per gal.	Av. gal. of paint used on 70-ft. car
Sprayed (Based on 81 individual cars handled between Jan. 13, 1931, and Feb. 26)								
First body color	58.0	3,829.5	1,000.5	18.29	$.15	$3.292	12.0	1.52
Second body color	60.0	3,932.5	827.0	14.72	.31	4.563	11.0	1.34
First letterboard red	57.0	3,785.5	218.5	4.04	.12	.485	12.0	.34
Second letterboard red	59.0	3,888.5	140.5	2.53	.43	1.088	9.5	.27
Exterior varnish	116.0	7,617.5	1,397.0	12.84	.43	5.521	7.5	1.71
Interior varnish	24.5	1,652.5	182.5	7.73	.21	1.623	7.0	1.10
Mahogany base	27.0	1,775.0	330.5	13.03	.16	2.085	8.0	1.63
Floor	28.0	1,827.0	171.0	6.55	.12	.786	10.0	.66
Vitralite ceiling	8.0	466.0	98.0	14.72	.29	4.629	12.0	1.23
Baggage-car ceiling	21.0	1,290.5	301.0	16.33	.22	3.593	11.0	1.49
Baggage-car wall	19.0	1,107.5	322.0	20.35	.22	4.477	11.0	1.85
Roof (incl. Lucas cement)	67.0	4.500.5	1,695.0	26.36	.10	2.636	13.0	2.03
Iron black	71.0	4,687.5	987.0	14.74	.13	1.916	7.0	2.11
Vestibule red, two vestibules per coat	38.0	.....	173.5	4.57	.46	2.102	9.5	.48
Truck enamel, two trucks per coat	55.5	.....	738.0	13.30	.12	1.596	9.0	1.48
Truck shellac, two trucks per coat	54.5	.....	488.0	8.95	.15	1.343	7.5	1.19
Brushed * (Based on 33 individual cars turned out of shop in October, 1930)								
First body color	33	2,079	338	11.38	.18	2.048	12.0	.95
Second body color **	33	2,079	360	12.12	.31	3.757	11.0	1.10
First signboard red	32	2,043	96	3.29	.12	.395	12.0	.28
Second signboard red **	32	2,043	61	2.10	.43	.903	9.5	.22
Exterior varnish	50	3,171	491	10.84	.43	4.661	7.5	1.45

* Figures for brush work confined to above five materials to be certain that a fair comparison with spray work is made.
** Second body color and second letterboard red include the red and yellow vitralite used on the ends of head-end cars.

criss-cross method of spraying instead of the straight up and down method. Obviously, these practices have resulted in more paint material being used than would otherwise be the case. Therefore, the increased amount of paint used in spraying, compared with brushing, cannot be charged solely to waste. From observing the spray work being done and the amount of paint on the spray-booth floors and hoods, it seems that the material actually lost is a very small percentage of that used.

The increased cost of material used on a 70-ft. passenger-carrying car turned out of shop under the present spraying method is $5.38 (Table IV). The average cost of the material used under the present spray-booth method is $38.83 per car, compared with $33.45 under the former brushing spraying method.

Based on an output of three cars a day, the output being at the ratio of two head-end cars to three passenger-carrying cars, and at the average car length of 60 ft. for head-end cars and 63 ft. for passenger-carrying cars, the average increased cost is $12.88 a day for the paint used by the spray booths compared with the former methods. This gives an average increased material cost of $4.29 per car turned out.

Referring to Table IV, the labor costs are based on painters and sprayers only and do not include the auxiliary forces except for one sprayers' helper for each method. The figures show that about $29.55 in direct labor and material is saved for each 70-ft. passenger-carrying car turned out of shop. The savings will, of course, vary according to the kind and length of the car, and the amount of work on them that is now sprayed and which was formerly brushed.

The figures also show that under the former method the labor cost was greater than the material cost, whereas under the present spraying method the material cost is greater than the labor cost, a complete reversal.

Labor and Material Charge-Out Method

The operation of the spray booths necessitated a change in the method of charging labor and material to individual cars. Formerly, each painter charged to each car he worked on the actual number of hours he worked on it. In the spray booths, this method was found impractical due to the numerous jobs each sprayer worked on and the shortness of the working time per job. Therefore, each sprayer spreads his daily eight hours over the number of cars he worked on that day. Each individual car gets an approximately correct charge.

In the matter of charging out material under the former method, the mixing room weighed and charged the material to each individual car and weighed and credited each individual car with the unused material returned. This method was found impractical for the spray booths for it is evident that paint could not be removed from spraying containers and hose and weighed every time a different car was worked on. Therefore, the mixing room each day weighs and charges against the spray booths all outgoing material and weighs and credits the spray booths with all material returned. The spray booths each day furnish the mixing room with a list showing the work done on each car handled, and from this the mixing room charges the used material against the individual cars.

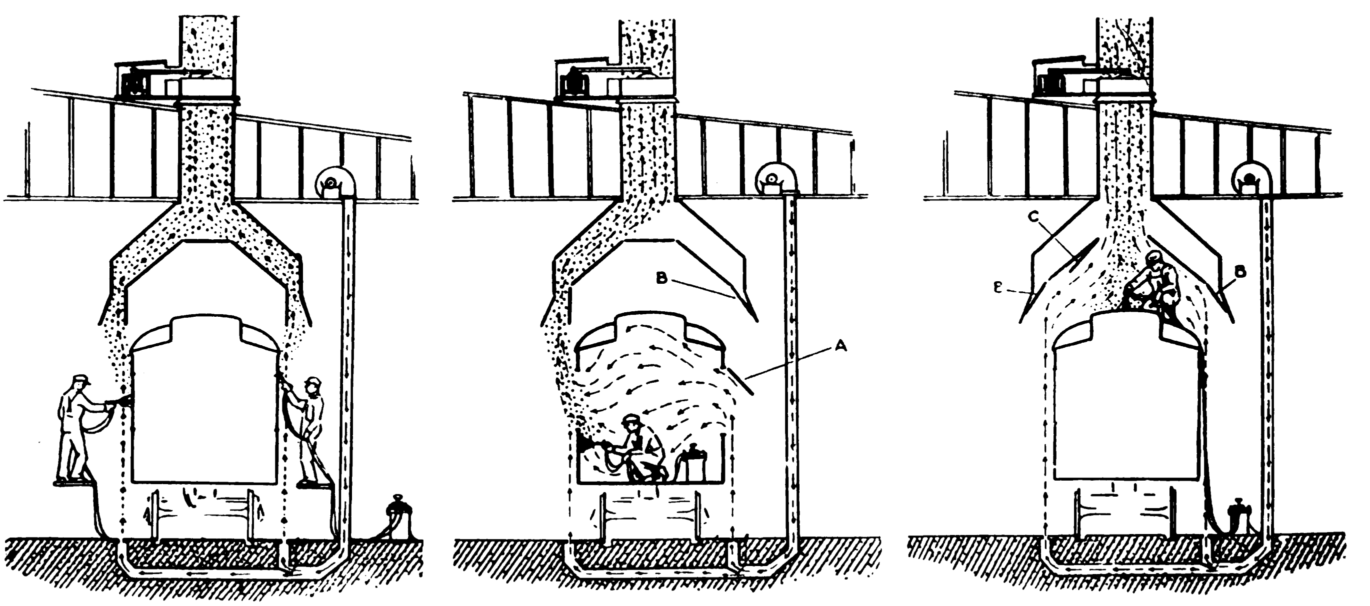
Car Movements

The movement of cars in and out of the spray booths, and between and in and out of the coach shops has become an important operation since the spray booths started. During a normal day, 16 cars are moved in and out of the spray booths, three cars enter and three cars leave the coach shops, and three cars move from the old shop to the new shop and three cars move from the new shop to the spray booths. This gives 25 car moves on the old shop transfer table each day, or a car movement every 19 min. Only by using a tractor for pushing and pulling cars in and out of shop, and pulling them between shops, has it been possible for the old shop transfer table to handle the other movements. The tractor speeds up the operation.

An actual check made during the study period showed that an average of 15.73 cars were moved in and out of the spray booths each day, and the time that elapsed between the pulling out of one car and the putting in of another car was 16 min., 24 sec. Therefore, each day an average of 2 hours, 9 minutes was lost in the spray booths, due to empty stalls between the out and in car movements. In other words, of the 32 car-hours (4 stalls x 8 hours) in the spray booths, 6.25 per cent was lost or unproductive due to car movements.

Speeds Up the Shop Work

The spray booths have resulted in a speeding up of the



Operation of canopy-type car exhaust for exterior, interior and roof painting

Table IV—Average Cost of Spraying a 70-Ft. Passenger Carrying Car (All Classes), Compared with Former Brushing Spraying Method

	Material Costs						Labor Costs					
	Lb. of material used			Cost of material used			Number of man-hours spent			Cost of direct labor used		
	Former brush and spray	Present spray booths	Approximate increase	Former brush and spray	Present spray booths	Approximate increase	Former brush and spray	Present spray booths	Approximate decrease	Former brush and spray	Present spray booths	Approximate decrease
					Formerly brushed							
First letterboard red *	3.29	4.04	.75	$ .395	$ .485	$ .090	....			.....		
Second letterboard red *	2.10	2.53	.43	.903	1.088	.185	....			.....		
First body color	11.38	18.29	6.91	2.048	3.292	1.244	10			$ 8.00		
Second body color	12.12	14.72	2.60	3.757	4.563	.806	10			8.00		
Exterior varnish (2 coats)	21.68	25.68	4.00	9.322	11.042	1.720	20	See Note A		16.00	See Note B	
Interior varnish **	6.52	7.73	1.21	1.369	1.623	.254	16			12.80		
Vestibules **	3.63	4.57	.94	1.670	2.102	.432	4			3.20		
Vitrolite ceiling **	12.50	14.72	2.22	3.625	4.269	.644	10			8.00		
Total formerly brushed	73.22	92.28	19.06	$23.089	$28.464	$ 5.375	70			$56.00		
					Formerly sprayed							
Mahogany base	13.03	13.03		$ 2.085	$ 2.085		4			$ 3.20		
Floor	6.55	6.55		.786	.786		....			.....		
Truck enamel	13.30	13.30	See Note C	1.596	1.596	See Note C	2	See Note A		1.60	See Note B	
Truck shellac	8.95	8.95		1.343	1.343		....			.....		
Roof (Note D)	26.36	26.36		2.636	2.636		5.3			3.65		
Iron black	14.74	14.74		1.916	1.916		....			.....		
Total formerly sprayed	82.93	82.93		$10.362			11.3			$ 8.45		
Grand total—70-ft. car	156.15	175.21	19.06	$33.451	$38.826	$ 5.375	81.3	40.3	41.0	$64.45	$29.52	$34.93

Note A—Present man-hour saving is 50.4 per cent per Table II—Hence thus figured.
Note B—Present labor cost saving is 54.2 per cent per Table II—Hence thus figured.
Note C—No more material consumed in present spraying than in former spraying.
Note D—Includes Lucas cement.
* —Labor cost included with body colors.
**—Material formerly used with brush is estimated

AVERAGE SAVING PER CAR

	Former brush and spray	Present spray booths
Labor	$64.45	$29.52
Material	33.45	38.83
Total	$97.90	$68.35
Saving	.....	$29.55

entire shops. The booths can be compared to a hungry beast which must be fed each day with three cars for first coat color. It is necessary for the coach repair shops and all its auxiliary departments to furnish the three cars. The result has been a faster performance in the repair and manufacturing shops.

Formerly, when a car for any reason could not be shifted, it resulted in only a trifling delay because the painters could move to the car and paint it where it stood. No time was lost. Under the present method, unless a car is shifted, no paint is applied and each outside coat of paint represents one day in the shop. This problem has been met by selecting another car to shift in place of one that cannot meet its shifting date. It is evident from the above that work must be completed on time or serious delays result. The result has been a speeding up in the coach repair shops so as to have cars ready for movement into the spray booths. Obviously, when one car is selected to shift in place of another car, it means the changing of the shop schedule dates as well as the out-of-shop date for the cars involved.

To avoid wasted time, the trimmers are not allowed to start trimming a car until it has left the spray booths completely painted. This ruling was necessary to prevent delays in the spray booths which would result if cars could not be promptly moved when wanted. Also, it avoids a continuous switching around of trimmers, etc., which would result if they were allowed to work on cars scheduled to enter the booths on a moment's notice.

Workmanship

The workmanship of the painting jobs done by spray has steadily improved with the increased experience of the sprayers. The jobs seemingly should be more durable than those formerly brushed inasmuch as heavier coats are applied to the surfaces.

It has been found that the greatest foe to good workmanship is dirt. The booths have combatted dirt by drowning it in heavy coats of paint and varnish. Also, the spray booths are kept as clean as possible, the floor is wetted down, incoming cars are swept out before entering the booths, and traffic through the booths has been stopped. Again, by properly regulating the air drafts from the fans and blowers, the dust floating in the air has been lessened.

Undoubtedly, quick-drying varnish made from synthetic gums will be a great aid in preventing dirt from collecting on the cars, especially after the cars leave the spray booths.

Miscellaneous

Nineteen, or more, different kinds of paint materials are used on Milwaukee cars. The use of various kinds of paint results not only in much "cutting in," but also in much cleaning of spraying equipment when sprayers change from one material to another. It also, without doubt, slightly increases the amount of material used.

It is estimated that the spraying force could be reduced one sprayer—a labor reduction of 12.5 per cent—if one solid outside body color were used on Milwaukee cars instead of the various colors now used.

The paint materials used by the sprayers were identical with the materials that were formerly applied by brush. The operation of the spray boths resulted in no change in the kinds of paint materials used. Lacquer is not used on Milwaukee cars, and they are sprayed with paints and varnish.

"SAFETY-FIRST SHOES."—Shoes with a steel toe cap inside the leather cap are now worn by many shop employees of the New York, New Haven & Hartford and the company is so well satisfied with the design of the shoe, as a safeguard against foot accidents, that it has arranged to have salesmen travel throughout the company's lines to offer the shoes to employees; and payment may be made by deduction from the payroll. The shoes cost $3.95 a pair. In three months, on this road, 119 foot injuries were sustained by employees, 32 of which were of sufficient importance to be reported to the Interstate Commerce Commission. These injuries altogether led to 1,074 days' lost time. The shoes are recommended to shopmen, car inspectors, trackmen, and all classes where the hazard is appreciable.

Is the Big Car Shop Justified?

By B. C. Richmond

UNDER normal business conditions, the actual cost of maintaining freight cars per car is of relatively less importance than it is under traffic conditions such as are being experienced on the railroads at the present time. The demand then for freight equipment is so great that the importance of having serviceable cars outweighs any consideration of a small difference in the cost per car for repairs. However, when railway traffic falls off during business depressions, all costs on the operating expense side of the ledger are scrutinized carefully to determine where savings may be made.

This article is being written because of an idea on the part of the writer, based on several years' experience in car repair work, that in most cases it is cheaper to repair freight cars in several relatively small capacity repair shops, strategically located in relation to traffic, than it is to centralize freight-car repair work in one large shop designed to turn out from 40 to 60 cars a day. Comparative analyses of freight car repair costs under several conditions substantiated the contention that the smaller shop is more economical and raises the question, "Is the big shop justified?"

The author raises some pointed questions relative to the trend of car-repair work. Does the geographical make-up of most roads lend itself to the one-shop idea? Has the trend toward the concentration of car-repair work reached its peak? Do the fixed charges on large repair plants offset the savings made by mass-production methods?

Practically every well-operated railroad has freight-car repair shops of some description at several points on the road at the present time. During the past five years the trend in shop practice has been, on many roads, to abandon these smaller shops and concentrate freight car repairs at one large-capacity modern repair shop. The big shop—one turning out from 40 to 60 general-repair or rebuilt cars a day—is a most uneconomical investment at any time when it is not operated at from 85 to 100 per cent of its capacity on repairs of this class alone. There is no justification whatever for a shop of this size being built or used for making light repairs at any time. The minute this is done the cost of making such lighter repairs increases all out of proportion to the value of the repair work performed. The thought is that most roads could much better afford to spend a rather liberal amount of money in modernizing the several relatively small repair plants now in existence on their lines, provided that these repair plants are located at strategic points in relation to traffic.

Classification of Car Repairs

Since the time of the United States Railroad Administration, when a definite classification of locomotive repairs was set up on all the railroads under Federal control, there has been no confusion in the minds of railroad men concerning the classification of locomotive repairs. They are fixed and definite. No such condition exists as far as car repairs are concerned, and while it is more or less common practice on most roads to set up certain classifications of car repairs, it can be shown that in relation to shop operations such classifications mean very little. The only classification that exists at the present time on car repairs which is common to all roads is that set up by the Interstate Commerce Commission which specifies that all cars requiring between one and 20 man-hours per car for repairs shall be known as light repairs and all cars requiring 20 and over man-hours be known as heavy repairs. When it is considered that the heavier repairs on cars will average from 35 to 100 man-hours of direct car labor—not including such items as painters, air brake men, etc.—it can be seen that such a classification serves no useful purpose in analyzing car repair programs or costs.

Many roads use a classification of freight car repairs such as the following:

Class 1—Cars requiring one man-hour or less
Class 2—Cars requiring one to 20 man-hours, inclusive
Class 3—Cars requiring 21 to 100 man-hours, inclusive
Class 4—Cars requiring 101 man-hours and over

The inadequacy of such a car-repair classification is evident when it is considered that the classification depends upon the man-hours to make the repairs on a car and the man-hours required to make the repair depends entirely upon the shop and facilities at which the repairs are made. It can be seen, for example, that on a road with a main shop which requires an average of 85 man-hours to make general repairs to a 55-ton hopper car, it is possible that an emergency might require general repairs to be made on such a car at some small outlying point which, because of lack of modern facilities, could not repair the car in less than, say, 150 hours. The same car receiving the same repairs would, at the main shop, fall under Class 3, while for the repairs at the outlying shop it would fall into Class 4. Therefore, when a comparison of car repair costs is made on the basis of any such classification, it can readily be seen why it is not a true and accurate comparison.

Determining Shop Output

In determining shop output on a basis of classification consideration must be given to this variation in the ability of different shops to repair cars. Some roads schedule car repairs by series or groups for general or intermediate repairs and anticipate that a certain number of other cars will be repaired. These "other" cars are those unusual repair jobs which are occasioned by wrecks, etc. Usually the large heavy-repair shops are

designed with the idea of including in their repair operations many such non-program cars. Many times, under certain conditions of traffic, it is necessary to shop a large number of cars, the repairs on which are of a lighter nature than "general" or "rebuilt" in order to justify the existence of the big shop for the reason that not enough general-repair cars are available to keep the shop operating at an economical capacity. In other words, the heavy fixed charges involved in connection with the big shop must be spread over a large number of cars in order to keep the average cost per car as low as possible.

A railroad owning 50,000 steel cars would be obliged to repair on a "general" or "rebuilt" basis only about 14 cars for each working day in order properly to maintain the equipment on the basis of 12 years service life. The 50,000 cars would probably require intermediate repairs and painting at a six-year interval which would increase the required daily output by 27 cars, making a total of 41 cars a day receiving repairs, only 14 of which are of a nature which would justify putting them through the big shop. A big shop is designed primarily for making the heaviest repairs. Under certain conditions a road may be justified in including a limited number of intermediate repairs—say 25 to 30 per cent of the output. If light repair cars are moved into the big shop simply to provide output for the big shop, it will usually be found that small terminal or division shops are short of work for their repair men. A certain force is necessary at these outlying points to perform running repairs and, because of the fact that ordinary running repairs require only a portion of the time of this force, practically every road figures that the remaining time of these repair men be occupied with a certain number of heavier repairs each month. Therefore, when the big shop takes all of the heavy repairs, it leaves the repair forces at outlying points, which must be maintained in any event, with only half enough work to do. It so happens in many cases that supervisors will deliberately "bad order" cars which are still in serviceable condition in order to create work for repair forces that might otherwise be idle.

"The minute the big shop is used for making light repairs, their cost increases out of all proportion to the value of the work performed."

"When the big shop takes all the heavy repairs, it leaves the repair forces at outlying points, which must be maintained in any event, with only half enough work to do."

Shop Location Important

There are only about four or five railroads in the United States of any size, the geographical and traffic nature of which is such that the freight equipment might economically be repaired in one centrally-located shop. As far as most roads are concerned the location of the car-repair shop or shops in relation to the types and nature of its traffic is vitally important. Where, then, should the big shop be located?

Shop locations should be based on the assumption:

(a) That the equipment is being repaired in the territory where the lading for which that particular type of equipment is used, originates or in the territory from which the cars are distributed.

(b) That, if cars are not repaired in loading or distributing territory, the transportation costs on the empty car from loading territory to the shop and return does not exceed the savings which it is expected can be made in the central shop in mechanical repair costs.

There is a distinct advantage in being able to repair cars in loading territory. A road with diversified freight business such as coal, grain, live stock, automobiles and parts or accessories would, in all probability, be unable to find a central location for a car shop. As an example, consider a hypothetical trunk line extending from coast to coast divided into two operating sections—lines east of Chicago and lines west of Chicago. The lines east extend into the Western Pennsylvania, southern Ohio, Indiana and southern Illinois coal fields and into the Ohio, Indiana and Michigan automobile industrial centers. The coal movement would be in a northerly direction from the mines to the main line on four different feeder lines meeting the main line at points approximately 100 miles apart and within a 400-mile territory. The automobile traffic loads from three points practically on the main line and two off-line points. With two exceptions all of these points are within territorial limits 120 miles from a central location, the two exceptions being within 250 miles. The grain and live stock movement is from the western terminus east on the main line. The movement from the eastern terminus west on the main line consists principally of empties and of merchandise and manufactured products. The loaded coal movement in several instances ends at Great Lakes ports, the cars returning empty to the mines. Part of the coal, after reaching the main line, is moved in both easternly and westernly directions and the empties returned to the mines. However, due to the geographical distribution of bituminous coal resources, long hauls are usually unnecessary and the greater part of the feeder-line coal-carrying cars are operated in a territory restricted practically to that feeder line and 50 to 100 miles of adjacent main line. Therefore, any central shop for coal-car repairs would entail a considerable amount of empty-car mileage. In the case of cars used in automobile traffic a moderate sized centrally-located shop would fulfill the requirements for repaired cars.

On the Western lines the principal eastbound movement would be fruit, livestock and grain. The fruit originates in the far west, the live stock in the southwest and the grain in the central western states. From southern lines extending to the Gulf the north and eastbound movement would consist of fruit, grain, lumber and oil. The west and southbound movement would be empty cars and merchandise and manufactured articles. The logical locations for car repair plants on the lines west of Chicago would be as follows: For refrigerator cars, one shop on the west coast; livestock cars and grain cars are distributed for loading from the central west and repairs should be made in that territory. On the southwest lines the refrigerator cars should be repaired in a shop in the Gulf States; cars for grain and lumber are distributed from central western termini and because of the converging traffic of the western and southwestern lines in this central western distributing territory the repairs on stock, box and open-top equipment could be handled in two or three moderate sized shops each spe-

cializing on the repairs to specific classes of cars. Inasmuch as most of the tank cars are owned by the oil producers their maintenance is not a serious problem of the railroad.

There is a charge of five cents a mile for empty car movement which is used by practically all roads. With centrally located shops there would be considerable empty car mileage from the traffic originating and distributing points to the shop and return. This would involve a substantial charge per car which must be considered along with the actual cost of making repairs.

Shop Costs Compared

In making any comparison of repair facilities it must be done on some definite basis. The basis selected for use in this article is a comparison between freight-car repair programs on a road owning 50,000 freight cars, 37 per cent of which are box cars, 40 per cent open-top equipment, 16 per cent other revenue cars and 7 per cent non-revenue cars. The present set-up on this road is assumed to be four repair plants of moderate size already in existence and located at different points on the road. These repair plants, because of a lack of modern facilities, are considered to be inadequate to meet present day car-repair needs and it is now a question of installing modern shop facilities. The question that has arisen is whether one large centrally located shop should be built or a certain amount of money spent for the modernization of existing facilities.

An analysis of the car-repair requirements on this road indicates the desirability of having shop facilities capable of turning out 14 general-repair or rebuilt cars and 27 intermediate repairs each working day, or 12,300 cars a year. In addition to this there would be a certain number of miscellaneous cars requiring varying degrees of repairs due to accidents, etc. Making a certain reserve allowance of shop capacity for future needs, an analysis indicates the desirability of having a total shop output capacity of approximately 60 cars a day. To meet this requirement, two solutions are possible—one shop capable of meeting the entire requirements or the modernization of the four small shops to produce an average output of 15 cars a day each. Preliminary estimates of costs based on the actual experience of some roads in constructing large shops place the cost of a single repair plant capable of turning out 60 cars a day at $3,000,000 to $3,500,000. Similar estimates as to the cost of modernizing four existing repair shops in such a manner as to increase their output to 15 cars a day would cost about $80,000 apiece or $320,000 for the four shops. The present book value of the existing facilities is assumed to be in the neighborhood of $800,000 for the four shops, making a total investment of $1,120,000 for the four shops should they be modernized.

An investigation of the fixed charges in connection with the big shop—the $3,500,000 shop—as compared with the four smaller shops involving slightly over $1,000,000 discloses the fact that the annual cost of interest at 6 per cent, depreciation at 4 per cent, taxes, fuel, water, light, electric power, insurance and maintenance of buildings and equipment distributed over 12,300 cars is $38.70 per car for the big shop as compared with $13.90 for the four small modernized shops. Using an average cost of $300 for the general and intermediate repairs on these 12,300 cars, the fixed shop charges represent in the case of the big shop 12.9 per cent of the repair cost as compared with 4.6 per cent in the case of the small shop. Is the big shop justified?

Ten years ago there was every indication, based upon years of railroad history, that railroad traffic would increase in a proportion which bore a definite relation to increases in population. Upon such an assumption the railroads were justified in recommending expansion of facilities to care for constantly increasing repair requirements. The situation is now changed. There is every indication that the peak in traffic increases has been reached and this, together with increased transportation-department efficiency, indicates that the need for great increases in car-shop capacity no longer exists. This opinion is corroborated to a certain extent by the fact that the modern trend is toward the steel car which need be shopped for general repairs only every 12 to 15 years as compared with average shopping periods of approximately six years on the old wooden equipment. Under present conditions the policy of the railroads as related to repair facilities should be to consider very carefully proposed expenditures made solely for the purpose of increasing capacity. On the other hand, present conditions are forcing attention, more than ever before, upon the necessity of reducing operating expenses and the installation of modern equipment is one of the many ways in which money can be spent which will not only hold within moderate limits the fixed charges but will make a substantial return on the investment.

Why the Old Shop Fails

Many car-department supervisors reach the conclusion that facilities which have been in use for a number of years are totally inadequate to meet present day needs and that the only solution to the problem is the complete abandonment of these facilities and the erection of new and modern layouts. To a certain extent, this is true, particularly in cases were the shop layout is so broken up by buildings occupied by other departments that it is impossible to concentrate the car work in one place in an economical manner and in cases where the buildings themselves are in such physical condition as to require extensive repairs to fit them for use. In such cases probably the most economical thing to do is to dismantle the buildings completely and replace them with new buildings. On the other hand, many present car-repair plants are housed in buildings that are not undesirable from the standpoint of layout and which have, with slight repairs, many years of remaining service life. These are the shops in which moderate expenditures for modernization will provide a satisfactory return on the investment in better facilities.

The labor force in any car-repair shop is capable of turning out a certain number of cars a day—this output being definitely limited in direct relation to the number and type of facilities in the shop. The problem of increasing the output of car-repair work and reducing the cost of maintenance per car is not one of replacing men with machines but is rather a problem of supplementing labor with sufficient facilities and tools to obtain the maximum output from a given force.

Problems Requiring Solution

Before entering upon any discussion of the details of shop layout and equipment, there is one point worth mentioning. A debatable question among car men in the matter of shop layout has always been that of the relative efficiency of the dead-end shop as compared with the through-track open-end shop. Many car-repair shops at outlying points have been abandoned simply because they were dead-end shops with the feeling that it is not possible to equip and operate a dead-end shop so as to equal the efficiency of a shop where the cars can move into, through and out of the shop in a straight line. It is not within the province of this article to

become involved in any detailed analysis of the two types of shops but experience has proved conclusively to the writer that the dead-end shop, particularly in the small units such as we are discussing here, can be operated just as economically if not more so than the through type of shop.

In setting up the recommendations for the modernization of existing plants, it is assumed in this article that no steel car materials are fabricated in the shop. The present tendency on most progressive roads is to purchase fabricated car parts from the manufacturers and thereby eliminate the investment in shop equipment required to perform this work.

Machine Tools and Shop Equipment Necessary to Repair 60 General or Rebuilt Cars a Month

	Old Shop	New Shop			
		Open-top cars		House cars	
Machine		A	B	C	D
Shop piped for oxy-acetylene	No	Yes	Yes	Yes	Yes
Sand blast equipment	Q	Yes	Yes	Yes	Yes
Spray painting equipment	Q	Yes	Yes	Yes	Yes
15-ton traveling crane	No	Yes	Yes	Yes	Yes
Jib cranes, 5-ton electric hoists	No	2	2	2	2
Storage-battery crane truck	No	1	1	1	1
Gasoline tractor	Yes	2	2	1	1
Caterpillar tractor	No	1	1	1	1
Oil- or gas-fired straightening furnaces 10-ft. by 10-ft. inside	Yes	2	2	2	2
Electric hoists, 1½ tons capacity	No	2	2	2	2
Electric hoists, 3 tons capacity	No	1	1	1	1
Blacksmith forges	Yes	2	2	2	2
Motor-driven blast fan	No	1	1	1	1
Air compressor, motor-driven, 500 c.f.m.	One	2	2	2	2
Portable arc welder	No	1	1	1	1
Pneumatic car-lifting jacks, 50 tons	No	10	10	10	10
Ratchet car jacks, 35 tons	Yes	12	12	12	12
Straightening jacks, push and pull	O	10	10	4	4
Pneumatic backing-out hammers	No	10	10	6	6
Power trimming saws, electric	No	0	0	2	2
Rivet heaters, gas or oil	Q	45	45	30	30
Pneumatic riveting hammers	Q	30	30	18	18
Electric winch for pulling cars	No	1	1	1	1
Electrically driven pneumatic hammer, 1,500-lb.	No	1	1	1	1
Power hammer	No	1	1	1	1
Forging machine	No	1	1	1	1
Double-end grinder	One	2	2	2	2
Grindstone	One	1	1	1	1
Double-end hydraulic wheel press	One	1	1	1	1
48-in. car-wheel boring mill	One	•1	1	1	1
Steel-wheel turning lathe	One	1	0	1	0
Axle lathe	One	1	1	1	1
Car-wheel journal lathe	One	1	1	1	1
Pipe-threading machine	One	1	1	1	1
Pneumatic pipe vise	No	1	1	1	1
Pneumatic pipe bender	No	1	1	1	1
24-in. wood planer	Yes	0	0	1	1
Universal wood worker	No	1	1	1	1
24-in, rip saw	Yes	0	0	1	1
16-in rip saw	Yes	1	1	1	1
Band saw	Yes	1	1	1	1
36-in. cut-off saw	Yes	0	0	1	1
16-in. cut-off saw	Yes	1	1	1	1

Another important problem that must be solved in any discussion of car-repair shops is a question of handling wheel and axle work. While some roads have a great part, if not all, of the wheel and axle work handled outside their own shops, it is assumed in this article that the railroad is handling its own wheel and axle work. The question then resolves itself into one of deciding whether the wheel and axle work shall be handled in one centrally located wheel shop or at two or four points on the road. It might be well to mention here that the comparison in this article is being drawn between a central car repair shop turning out 60 cars a day and four shops of moderate size shops located at four points on the system each turning out 15 cars a day. An analysis of the wheel problem will indicate the facilities required for handling wheel work.

A road having 50,000 freight cars, 2,000 to 2,500 of which are equipped with steel wheels, will find it necessary to provide facilities to turning about 700 pairs of steel wheels a month. This figure of 700 pairs a month includes not only the cars owned by the railroad but the wheels turned for foreign cars. To perform this work will require the full time operation of two modern wheel lathes. In addition, to care for the machine work required on cast-iron wheels, axles and the mounting and demounting of wheels, will require the following machine tools assigned exclusively to wheel and axle work:

4—car-wheel boring mills
4—axle lathes
4—wheel presses
4—car wheel journal lathes

Regardless of whether the wheel work is handled in one shop or at four different shops the output of mounted wheels for a road with 50,000 cars remains the same—about 40 to 45 pairs a day. As far as the machine-tool equipment is concerned, the only difference between performing the work in four shops and doing it at one central shop would be the difference in the number of wheel presses required. If the work is performed at four different points each having one wheel press, it will be necessary to use the press 50 per cent of the time on demounting wheels and the remaining time on mounting wheels. If the work is performed at one central shop, two wheel presses, one for mounting and one for demounting, will take care of all of the requirements. The saving in favor of the one central shop, therefore, insofar as investment in shop equipment is concerned, is the cost, interest, depreciation and maintenance on two wheel presses. Against this saving, however, must be charged the cost of transporting wheels from outlying points on the road to the wheel shop and returning them again to the point where they will be needed. On several roads this cost is figured on a freight charge of .007 cents per ton mile.

Handling Parts and Materials

All shop operations are divided into three phases—fabrication, delivery and assembly of material. In the shops being discussed in this article we have already stated that there will be no fabrication. Therefore, the shop operations with which we are concerned are those of the delivery and the assembly of material. Adequate material-handling equipment is of great importance in both of these phases of operation. It has been stated previously in this article that a given labor force is limited in its ability to turn out repaired cars only by the facilities which are provided for the force to work with—assuming, of course, that the problems of organization and personnel have been solved. It is impossible to deliver or assemble the amount of material required in normal car-repair operations by manual labor alone without involving an excessive number of men. A labor force of 200 men, including supervision, should be entirely adequate to turn out 15 general or rebuilt and intermediate repairs a day. Time studies on several small shops actually in operation indicate that such a force, without modern facilities, cannot turn out 15 cars a day. One such shop, with a total force of 208 men, was actually getting 12 cars a day with a labor force involving 120 men employed on direct car-repair work and 88 men on indirect labor. This same shop, when equipped with modern material-handling equipment and tools, involving an investment of less than $75,000, increased its daily output from 12 to 17 cars with no change in the total number of men employed. The distribution of the men employed however, changed, for under the new layout less men were required on indirect labor operations and more could be utilized on direct car-repair operations. The distibution under the new set-up was 148 car repairers and 60 men whose time was charged as indirect labor.

It is unnecessary to go into detail as to just why cer-

tain items are recommended or what they are used for. The recommended improvements in four shops of the size considered above are shown in Table I. An explanation of the table will clarify its purpose. The items listed in the table represent a complete list of the major equipment required in a shop for steel and composite freight-car repairs. There are, of course, other small miscellaneous pieces of equipment that have been omitted from the list simply because they are in common use in all shops. In the column headed "Old Shop" are several notations indicating whether or not the old facilities included the item mentioned. In connection with those items marked "Q" this is meant to indicate that it is questionable whether or not the old shops are equipped with those items or, if equipped, whether or not they are adequately equipped. There are four columns headed "New Shop." In the first two columns, A and B, are listed the amount of equipment in two of the four shops assigned to repair work on all-steel open-top cars, while in the remaining two columns, C and D, is similar information for the other two shops assigned to the repair of steel and composite house cars. Any one of the four columns in the table will provide a list of the equipment necessary to equip completely a shop having an output of 15 cars a day of the type mentioned while the total of the four columns will provide a list of the equipment necessary for an output of 60 cars a day. The difference between the quantities indicated per shop in the column headed "Old Shop" and the quantities under columns A, B, C and D, will provide a list of the tools and equipment required for modernizing the average shop now in existence.

Great Northern Modernizes Engine Terminals

(Continued from page 291)

At Grand Forks, N. D., also at Havre and Whitefish, Mont., electric-stack draft-fan units, of the Drafto type, have been installed in sections of the enginehouse with a view to more economical firing-up of locomotives and also to save the large amount of heat lost through the smoke jacks in cold weather. At smaller terminals, where existing boiler capacity has been insufficient to support the direct steaming system and not enough locomotives are handled to justify enlarging or renewing the power plant, the Great Northern has followed the practice of installing Drafto units to save steam for blowing and heating purposes and also to keep smoke and gases out of the enginehouse.

Boiler-Washing Facilities

Another development that has contributed materially to the improved efficiency of locomotive terminals on the Great Northern has been the extension of facilities for washing out and refilling locomotive boilers with hot water. This is particularly important in a territory such as that traversed by this road where frequent boiler washouts are required. It is also essential to have facilities of this type preliminary to the operation of direct steaming systems such as now in general use on that road. Within the last ten years no less than fourteen of the present locomotive terminals on the Great Northern have been equipped with hot-water washout and boiler filling plants so that every important terminal on this road is now equipped for washing and refilling locomotive boilers with hot water. A number of these plants have since been rehabilitated, steel and concrete hot-water tanks of larger capacity being substituted for the original wood tanks, more efficient separators and condensers have been installed with gratifying results.

No exact estimate in the form of figures or ratios can be offered to indicate the full value of these terminal improvements to the Great Northern. Statistics comparing the cost of handling locomotives turned at these terminals ten years ago with today would be clouded by developments in the character of motive power handled and other changes in operating conditions that have occurred during this interval. Almost all of the individual improvements are susceptible of such analysis as outlined. Probably the best appraisal of the combined effect of all improvements embraced in the entire terminal program would be to regard them as just one of the several important factors that are enabling the Great Northern to score the lowest operating ratio of any transcontinental road operating in its section of the country.

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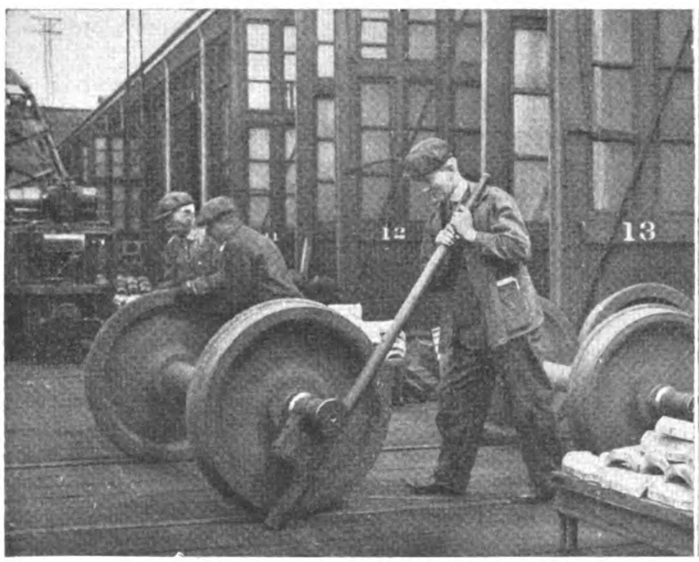


Handling wheels in the car shop

EDITORIALS

The Parting Of The Ways

The railroads, in their relation to machine tools and shop equipment, have arrived at much the same point as they have in relation to modern motive power. For years motive-power engineers, locomotive builders and others have been trying to sell the railroads to the idea that the investment in modern, efficient locomotives would result in substantial economies and, more than that, the continuance of obsolete types in service or even the attempt to modernize many obsolete types was not an economy but that it caused an actual operating loss.

Strange to say, it took a business depression to drive home a point that years of educational work had failed to impress upon some railroad officers. With the falling off of traffic and the consequent reduction of train miles it became necessary to store power but, unlike the farmer's Sunday suit, the newest power was not "put up in moth balls" until the old power was all worn out. Why not? Simply because it is obvious to almost any railroad man, whether he occupied the S. M. P's. job or is on the night shift at the engine house, that in times like these it is necessary to save money on operation and the old power cost too much to run—too much in fuel, too much in repairs—not to mention the fact that it was unsuited to modern operating conditions.

The average mechanical officer would demand an early explanation from any master mechanic today who would white-lead the new power and run the old. But that same officer will look askance at the shop superintendent or general foreman who has the temerity, in times like these, to ask for a new machine tool or unit of shop equipment. If the railroads, like other industries, had a predominance of modern facilities in their shops such a policy might be justified but almost any shop over ten years old contains many tools that should grace the scrap heap if for no other reason than to stop their excessive losses in operation and to stop the waste of material and the defects in service resulting from inaccurate work. The locomotive builder has shown the railroads the way to lower operating costs as far as motive power is concerned, yet in many cases the savings made on the road are wiped out by excessive maintenance costs in the back shop—costs that could be cut down if the same policy were applied to the shop as is applied to the motive-power problem.

This problem of reducing maintenance costs is one that is considerably deeper than the mere acquisition of new machine tools and shop equipment. It is a problem involving a study of the broad question of the economics of equipment maintenance. It is a problem that must be solved by the co-ordination of the proper facilities with an adequate well-trained labor force guided and controlled by policies that are flexible enough to detect improper and inefficient practices before they have run up heavy losses and to adopt without hesitation the developments which modern science and engineering have made available.

In the campaign on the reduction of operating expenses that must form a most essential part of railroad programs in the future the possibility of reducing locomotive repair costs presents a favorable opportunity if for no other reason than it is still the largest single item of railroad operating expense—over $400,000,000 annually for the Class I roads. In the years from 1923 to 1929 inclusive locomotive fuel costs have been reduced 37 per cent while 8,000 fewer locomotives have run within 4 per cent as many locomotive-miles. During the same period maintenance costs have gone down 25 per cent. It would appear that the designers and operators of the locomotive have made greater progress than those who maintain it.

Modern railroad repair plants, whether they be large units or small, have demonstrated their ability to cut unit costs. No one can deny that progress has been made but that $400,000,000 annual expenditure stands out at the top of the list as a challenge to all mechanical officers to turn their attention to a new avenue of savings. When the railroad repair plant is given the same acid test that the modern industrial production engineer applies to the manufacturing plant the railroads are going to discover that the margin between profit and loss is today so narrow that obsolete methods and facilities can no longer be tolerated.

Spray Painting Car Equipment

The spray painting of railroad cars, both passenger and freight, is now being carried on successfully by many roads, and undoubtedly this process will be used even more extensively in the future. Marked economies are effected in the labor cost of application, far more than offsetting a somewhat greater amount of paint material used, part of which may be charged to the application of heavier coats, which fill all cracks and crevices and have a proportionately greater protective service life. Another factor of great importance is the general reduction in time required for painting operations, and the consequent reduced shopping time and more prompt return of equipment to service. While not a vital consideration at present, with the reduced demand for equipment, this factor is bound to be increasingly important in the future.

Among several roads quick to appreciate the possibilities of spray painting was the Chicago, Milwaukee, St. Paul & Pacific, which carries on heavy car maintenance operations primarily at the system shops, Milwaukee, Wis. It was not until something over a year ago, however, that these shops, in both the freight and passenger departments were furnished with suitable paint spraying equipment and exhaust hoods for the most satisfactory and general use of spray painting. The results secured in spraying freight cars will be discussed in a subsequent issue of the *Railway Mechanical Engineer*. The results with passenger equipment described in an article elsewhere in this issue, may be summarized as a saving of over $12,000 a year by the installation of equipment at a total aggregate cost of slightly over $37,000. This saving was accomplished while working an average of only four days a week and will, of course, be proportionately increased when the shops are returned to full-time operation.

The study of paint spraying operation and costs at the Milwaukee passenger shops of the C. M. St. P. & P., presented in this issue, is believed to be one of the

most comprehensive and informative investigations of its kind yet made and worthy of the closest scrutiny by all car men interested in more economical and satisfactory painting of passenger equipment. The study apparently proves beyond question the advisability of supplying passenger shops with necessary spray painting apparatus and ventilating systems to eliminate the health and fire hazards, so that the economies of this method of paint application may be made available to the railroads. The installations, when properly made as in the case of the Milwaukee shops, receive the approval of fire underwriters, state health and labor departments and promote greatly improved working conditions in the paint shop. As shown in the article, the spray painting of cars at Milwaukee shops during the test period resulted in a reduction of 50.4 per cent in man-hours and 54.2 per cent in direct labor costs. This was accompanied by a 9.8 per cent increase in paint materials per car only a negligible proportion of which, however, can be accurately classed as waste. Other attendant advantages of spray painting are clearly indicated in the article.

Obsolete Shop Equipment

Shop equipment, whether it be machine tools, material-handling equipment or small tools that can no longer be classed as modern, is a distinct liability in any shop. In times when earnings are high shop facilities that have passed their period of greatest economic usefulness are tolerated because the service that they can render, unsuited as it is to modern production demands, is needed. When railroad business conditions are as they have been for the past year, the up-to-date shop supervisor should be checking up pretty carefully on the operating costs of individual units in his shop in order to determine the actual savings that could be effected by their replacement.

An American business man, writing recently on industrial conditions, mentioned the fact that there are many industrial plants in this country and many individual units of equipment in some modern plants that can never be economically operated again because competition and the readjustment of prices will force production costs in the future to be reduced to such an extent that obsolete equipment cannot meet the output demand at a cost which will permit a profit. Many railroad shop men have felt that the need for shop equipment of the most modern design was not justified in a railroad shop because the shop is not engaged in the manufacture of a product which is sold in keen competition and, therefore, the production costs need not be watched as closely as would be necessary in a manufacturing plant. This is not true today. The product of a railroad is transportation and today rail transportation seems to be the object of the keenest competition in our recent industrial history. It seems fairly certain that even the return of better business conditions will not restore to the railroads the increasing annual revenue that has come their way for many years in the past.

The maintenance of equipment—locomotives and rolling stock—requires approximately one-third of all the money spent by the average railroad for operation and it is in the constant reduction of unit costs of operation that the railroads should have the greatest hope for increasing profits from rail-line operations. Mechanical-department officers have demonstrated that it is possible to haul longer trains with modern locomotives at substantial savings in operating costs and it is up to the mechanical-department supervisor to demonstrate that this modern power can be maintained in such a manner that no part of the savings made in operation will be absorbed by higher maintenance costs. Modern trains are not being hauled by 30-year old locomotives and it is not reasonable to expect that modern locomotives can be efficiently and economically maintained by obsolete shop equipment.

Foremen's Responsibilities Increasing

The responsibilities of a railway shop foreman in any department are already legion and may be said to be on the increase, because of the increasing necessity for economy and improved standards of maintenance. The provision of safe working conditions and the attainment of efficient operation are two of the most important of a foreman's responsibilities. With regard to safety, the records in accident prevention, established at many shops, engine terminals and car repair tracks during the past year are a glowing tribute to the way in which shop equipment and maintenance practices have been gone over with the utmost care to eliminate any conditions tending to promote accidents. Reportable accidents have been cut at some shops to an almost negligible quantity and steps taken to sustain the interest so that there may be no return to former undesirable conditions. In this work, the shop foreman and gang leaders are in the last analysis the most important factors, as it is by their encouragement and the inspiration of their example that shop men are induced to work together for safety and take drastic action in the case of individual workers who seem disposed to be careless about their own safety and that of the men who work with them.

Safety and production are closely allied, and it may be said without fear of successful contradiction that no shop in which unsafe equipment and hazardous methods are tolerated can produce the desired results with respect to output. Here again, the shop foreman or supervisor is the primary factor. The successful foreman attacks with energy and persistence both of these problems of safety and production, making the most of such facilities as are at hand, and, at the same time, does not neglect to bring the needs of his department, in the way of improved machinery and safer equipment, to the attention of higher officers repeatedly, until such time as these needs are met. In these columns last month the opinion was expressed that higher railway officers should require shop foremen to justify the continued use of old, worn-out and antiquated machinery, instead of making them fight to get it replaced, as so frequently happens. Until such a policy is adopted, however, the shop foreman is not discharging his full responsibility so long as he passively acquiesces in the decision not to purchase new equipment which he knows will promote safety or effect substantial savings in shop operation.

Another primary responsibility of a shop foreman is, of course, to study men, learn their idiosyncrasies, deal fairly with them and thus encourage a feeling of respect and a willingness to offer suggestions for improvement which generally are obtainable in no other way. The foreman must, obviously, not only know how work in his department should be done and how long the individual operations require, but above all acquaint himself with the respective abilities, temperaments, initia-

tive, etc., of the men working for him, and in this way be in a position to promote or recommend for promotion the future supervisors. It is recognized that the workman of today is the foreman of tomorrow, and one of the most important duties and responsibilities of present foremen is to take pride in developing those who show signs of ability and loyalty to the interests of the company they serve.

Developments In Machine-Tool Design

Although there has been a marked decrease in the purchase of machine tools and shop equipment by the railroads during the past year, the manufacturers and builders have continued with unabated effort to improve their products and advance their designs for the purpose of decreasing railway shop production costs and increasing the serviceable life of repaired equipment. The outstanding developments in the refining of machine tool design have been greater ease of manipulation and further increase in the use of alloy steel and heat-treated parts to increase durability necessitated by the extended use of new cutting alloys. The wider use of anti-friction bearings and better lubricating systems is noticeable on practically all new machine tools designed during the past year.

The effect of the introduction of new cutting alloys on machine-tool design is noticeable in the decided trend towards the use of alloy steels in gears, spindles and all parts subject to wear and heavy stress. During the past year a lathe was introduced designed in its entirety for use with tungsten-carbide tools. The use of alloy steels in the design of this machine is indicative of the general trend. Grinding equipment for grinding tungsten-carbide tools was introduced by three manufacturers in the last six months of 1930, this also indicating the extended use of hard cutting alloys.

Practically all of the new machine tools are designed with lubricating systems to give either flood or full automatic lubrication, oil filterers of various kinds being incorporated in the systems to remove foreign matter. Considerable attention has also been given to the cutting-fluid circulating system with the objective of furnishing the fluid to the cutting tools in large quantities and of eliminating chips and dirt by the installation of filters.

There is a marked tendency on the part of the machine-tool builders to include alinement devices, some of which are used to check quickly the alinement of the machine as a unit and others for taking up the wear and alinement of parts.

A number of machine tools in which notable refinements were made were brought out since June of last year. Included in these is a 90-in. locomotive driving-wheel journal-grinding machine which is designed to produce a finished journal in 40 min. floor-to-floor time and to do work of such quality that the service life of the journal itself as well as the axle is increased. A 90-in. crank-pin quartering machine designed to quarter driving wheels to close tolerances was also introduced. This machine was designed to eliminate guess work in the quartering of driving wheels, thereby permitting closer work in the alining of side and main rods, and increasing the service life of the rod bushings. Of particular interest is a car-wheel boring machine with rapid traverse controlled by oil pressure to obtain heavier feeds and faster production and at the same time eliminate feed gearing. This machine includes a number of alloy-steel parts and also has anti-friction bearings.

Refinements in grinding equipment for finishing cylinder walls of air compressors, feedwater pumps, reverse-gear cylinders, fire-door cylinders, etc., were also made during the past year. In grinding equipment for this work attachments for producing accurate and finely finished boards have been brought out. One manufacturer brought out a machine for honing these cylinders which is designed to eliminate bell-mouthed and tapered cylinder walls.

Several manufacturers have designed automatic lathes, the tool or gang tool of which follows a template, the shape of which is the shape of the finished product. Jigs and fixtures have been brought out by manufacturers of milling machines and shapers to increase the adaptability of their equipment to railway repair work. One horizontal boring, milling and drilling machine was placed on the market, the main spindle of which gives 36 speeds in geometrical progression and which is designed with an auxiliary high-speed spindle mounted within the back-gear shaft of the main spindle to give an additional 36 speeds. Another manufacturer brought out a lathe equipped with a 16-speed triple-geared head with face-plate drive, the design of this latter machine provides eight out of the 16 spindle speeds through an internally-geared face-plate drive, the remaining eight spindle speeds being transmitted through the spindle gear. Another manufacturer introduced a welded band saw, the welding of the completed metal frame and stand being adopted to insure a machine which would be light in weight and rugged in construction, eliminating vibration and thus increasing the life of the saw blade.

During the past year there was considerable development in electric heat-treating equipment, melting furnaces, bar heaters and rivet heaters. The possibility of accurately controlling the furnace temperature has influenced a decided trend on the part of the railroads to adopt electricity for these purposes.

Refinements have also been made in welding equipment, extending the range of cutting and welding facilities. The increasing use of welding in the railway shops has also resulted in the design of many portable electric-welding machines, the trend in the design of this equipment being towards inherently-regulated single-operator machines. New machines for spot welding have also been developed.

There has been a marked development during the past year in various types of spraying equipment for the application of paints, varnishes and lacquers. Some of these are equipped with electrically-operated compressor units while others are equipped with gas-engine compressor units.

NEW BOOKS

THE CHEMICAL COMPOSITION AND PHYSICAL PROPERTIES OF HEAT-RESISTANT ALLOYS. *Reprint from the proceedings, volume 30, part 1, 1930, of the American Society for Testing Materials. Bound in cardboard, 6 in. by 9 in., 11 tables. Published by the American Society for Testing Materials, 1315 Spruce street, Philadelphia, Pa.*

The tables itemize the chemical compositions, physical and mechanical properties and corrosion-resistant properties of corrosion-resistant and heat-resistant alloys. The alloys are grouped according to manufacturer, listed alphabetically. The tables are split into six parts with an (a) and (b) section of each part, section (a) giving chemical compositions, and the physical and mechanical properties and section (b) the corrosion-resistant properties.

THE READER'S PAGE

Some Comments On Wheel Defects

To the Editor:

The letter on page 195 and the article on page 197 on wheel defects in the April issue were interesting to me. I believe the following statement of the causes of the various defects may be of interest.

Worn flanges are responsible for the removal of about 65 per cent of the cast-iron wheels and are caused from guiding the truck on the rail. Do we stop to consider, when a pair of wheels are removed for this defect, which have not run out the guarantee on the wheels, that there is some other mechanical defect on this truck, such as center casting broken or no lubrication, trucks out of square, side bearing riding and no lubrication, or wheels not mounted properly or not of the same tape size?

Brake burns are the cause for removal of a number of wheels each year. When a car is set out on the repair track for this defect, are the triple valve, brake levers and beams checked to ascertain that the brakes will not drag and again burn the wheels that are being applied?

Many wheels are taken out of service each year for chipped rims which are caused by striking high switch points and crossings. This defect is not as common in the single-plate wheel with the lip chill as on the double-plate with sand rim.

A small percentage of wheels are removed on account of broken rims, which are generally caused by a worn-through chilled wheel or a seam under the surface of the tread which cannot be detected until the wheel has broken.

The number of flat wheels removed has been reduced considerably in the last few years. Flat wheels are caused by one of four defects: Defective triple valve, too much braking power, hand brakes set, or wheels eccentrically bored.

Shelled out and comby treads are generally found on wheels that have been brake burned and run until spots are shelled out where the metal has cracked from the heat. One is found occasionally that looks like an oyster shell or a seam under the surface of the tread which is a foundry defect.

A cracked plate or bracket is generally found in a double-plate wheel about half way between the hub and rim or on the rim or outside plate. It is caused from a hot wheel on account of the brake shoe dragging. Very few defects of this kind are found in the single-plate wheel that has been generally adopted since 1928.

A few wheels are removed on account of cracked or broken hubs, which should be termed a wheel-shop defect. It can generally be traced to poor workmanship in the shop that mounted the wheels. It is also caused by heavy tonnage, tapered axle, wheel seat out of round, not properly lubricated at the press when mounted, and by boring out of round. The latter is caused by boring hard spots in hubs and hard hubs in one cut.

Steel wheel defects are similar to those in cast-iron or cast-steel wheels, except shelled treads. The cause of this defect has not been determined. It is believed that it is caused by metal being soft so that cold rolling on the surface sets in while in service. This starts checking and develops into progressive cracks that penetrate into the tread of the wheel and start shelling out. Relief from this trouble has been effected by using a better grade of wheels, such as those heat-treated in water or oil. In some service cold-rolled treads have given relief to shelled-out trouble.

Gas pockets or pipes, seams and shattered rim, if found under the surface of the tread, are factory defects and such wheels should be set to one side and held for the factory inspector.

J. R. Dunn.

Limited Use of Free Oil Defended

To the Editor:

The controversy regarding the use of free oil for supplementary lubrication of freight car journals is a very old one and each side has its advocates. Since there are a hundred or more conditions which separately, or in combination, may cause car journals to run hot, it is obvious that the injection into boxes of a small quantity of free oil will not eliminate hot-box trouble. On the other hand, a limited amount of free oil, intelligently used, will help reduce hot-box troubles that are directly attributable to the sponging being deficient in oil content; also, a surplus of oil may prevent boxes running hot due to disarranged packing, and other conditions that tend to restrict free lubrication. Local conditions, however, should govern, for while on the one hand free oiling will inevitably result in oil wastage, yet on the other hand its use may result in a sufficient reduction in hot-box train delays to justify such a course.

After boxes had been properly overhauled and repacked according to Rule 66, intelligently performed periodic respooning is the best hot-box preventive measure. Since the sponging suffers many times more disarrangement in cold weather than in warm weather the spooning attention will necessarily have to be at much more frequent intervals during cold winter months, and where temperature is cold enough to freeze the packing in a standing car the spooning should be done as soon as possible after the arrival of the car.

Sometimes the importance of making a good oil record in connection with journal-box repacking is overemphasized, resulting frequently in a deficiency of oil in packing, and at times even to a deficiency of packing in boxes. In such cases the normal oil losses may reduce the oil content to the danger limit before the next repacking date.

Free oil should be used sparingly and then only in such boxes as show evidence of a shortage of oil. Careful instructions to oilers, and a thorough supervision of their work, are necessary to prevent gross abuses where free oiling is practiced. Laying a pad of wet waste against the upgoing side of a journal is a small sop of oil to the box, and a sop to the conscience in not calling it "free oil." Such a practice is bad in that this loose and separated piece of packing is too easily dislocated, and the result is bound to be an abnormal number of waste-grab hot boxes.

It is well known that new sponging, either cotton or wool, becomes disarranged in the box much more readily than old packing. A good practice is to mix old and new packing. The presence of unspun fluff and short fibres in cotton waste is a prolific cause of waste wipes—small isolated particles of waste carried up under the

edge of the journal bearing forming a wiping pad. This trouble is particularly pronounced during cold weather, when the oil becomes a partly congealed, sticky mass, which drags these loose particles on the upgoing side of journal.

The best wool waste for use in cold climates is one composed of long strands of a hard weave material. Soft weave yarns and short strands are the chief cause for waste wipes, probably responsible for most of the hot boxes where wool waste is used.

While we are discussing lubrication of freight car journals why not start something on car oil? Since boxes are repacked only once a year, why two oils, summer and winter?

CAR DEPARTMENT OFFICER.

Comment on Standard Side-Bearing Clearance

TO THE EDITOR:

In the March issue of the *Railway Mechanical Engineer* a question was asked and answered by "A General Foreman"; "What is Standard Side-Bearing Clearance?" I wish to take exceptions to the definition of side-bearing clearance as described by the writer of the article.

In the first place the clearance of 1/8 in. to 5/16 in. is *per side bearing* and not per truck. Under no consideration should a truck have a flush side bearing, regardless of the fact that the other bearing may have the proper clearance. A flush side bearing will cause uneven distribution of the load, will cause journals to overheat and will cause undue flange wear on the wheels, and sometimes break off the flange or the lug on the journal bearings. A car with a flush side bearing is very susceptible to derailment, especially when entering or leaving a curve.

Side-bearing clearance should be kept to the minimum on house cars as they are most susceptible to car-body roll. Clearance should be as near equal as possible on all bearings so as to synchronize the car-body roll on both trucks.

JAMES McDONNELL.

An Answer to "Setting Southern Valve Gear"

TO THE EDITOR:

The Reader's Page of your May issue has a request for information on Southern valve gear. This man does have some marks that are confusing. I am of the opinion that this engine has had the valves set too many times by trailing the engine over.

The setting of valves is not a difficult process, but a very expensive one if it is to be guessed at and trailing over is one of the best guessing methods used. It is used for speed so as to be sure to get it all wrong and not know it at the time. After setting valves for several years and having considerable experience as a foreman, I am more than ever convinced that it is all guesswork. Trail an engine over, get some marks, make some changes, not knowing how the eccentric crank arms are, or the position of valve at dead center, or the amount of travel in front and back motion on both sides, and the engine goes out. It cannot be right. The man setting the valves has done a lot of work, but invariably it has to be done over.

The first operation in setting of valves is to see if all parts check to blue print sizes. Check this engine over with the blue print and the trouble will be located. Then get the dead centers, checking the travel on both sides as to lead and full travel, then the trouble can be located and the correct valve changes made. After this is done, the engine goes out and beats square, handles the train right and, most of all, saves coal.

Mr. Martin writes, "We understand the Walschaert and the Baker valve gear, but the Southern valve gear is different." There is one place that all valve gears are alike and that is when you have them on dead center. At this point, irrespective of the type of gear, the number of levers, or the source of motion, the valve must be at a certain place with relation to the port opening. Different types of gears have great claims over other types. Some have greater port openings, some have greater valve speeds, and so on. All the valve setter has to do is get the valve to open the same at all four points and he is done, providing all parts check to blue print size.

R. J. HALL,
Foreman, Missouri Pacific.

It Pays to Study Chill Worn Wheels

TO THE EDITOR:

The article on wheel inspection by D. M. Raymond, page 197 of April issue was very interesting to a man who handles wheels, but I cannot agree with Mr. Raymond on the worn-through-chill defect. If the inspectors depend on a loose box bolt or lid to indicate a chill-worn wheel, I believe that a good many wheels will be taken out of service that still have a lot of service miles left in them. If a wheel has started to wear through the chill, it can be detected by noting the height of the flange in three or four places on the wheel. Also, by noting rail worn marks on the tread of the wheel, it will be found that on a soft spot the rim of the wheel will look as if it is spreading out, or flaking off on the rim.

I think you will agree with me that it requires a car inspector of experience to find a chill-worn wheel in the first stages of wearing into soft iron. Supervisors, inspectors and carmen apprentices, the future inspectors and supervisors, should be sent to the wheel shop at regular intervals to inspect wheels that have condemning defects.

It is commendable practice to set aside brake-burnt, comby and shelled-out wheels and to break a few of them in two in order to acquaint supervisors, inspectors and apprentices with the depth of a brake burn or a heat crack in the tread of the wheel. You will find a very interested group of men when you get them together with a competent wheel man for this purpose and the time spent will more than be repaid in material and labor saved.

CAR INSPECTOR.

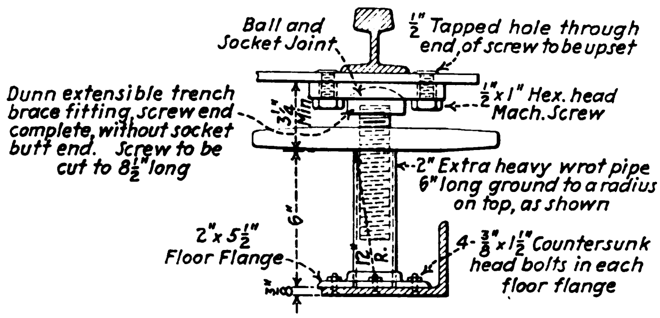
DOUBLE HEADLIGHTS.—Probably the only locomotive ever operated in this country with two headlights was the New York, New Haven & Hartford's old No. 129, which pulled the famous New England Limited, the "Ghost Train," on its non-stop run from Boston to Willimantic, Conn. The chief reason for equipping this engine with two headlights was to distinguish it as a limited train, one of the first by the way, in this country. The lights were mounted side by side on top of the smokebox, in front of the smokestack.

With the
Car Foremen and Inspectors

Florida East Coast Wheel Shop is Well Equipped

A BRIEF description of the wheel shop of the Florida East Coast which is located at its Miller Shops, St. Augustine, Fla., was published in the April, 1931, issue of the *Railway Mechanical Engineer*, page 181. This description showed two interior views of the shop and gave a complete list of the machine tools and equipment used in the shop. This list included a wheel-starting press which is used in connection with a Niles 400-ton wheel press.

A double-tier axle rack is centrally located with respect to the axle lathes, which are grouped together. Axles are handled from the lathes to the rack, and vice versa, by means of jib cranes. A 3-ft. track over which a light four-wheel truck is operated, extends from the storage rack at the axle lathes to another axle rack at



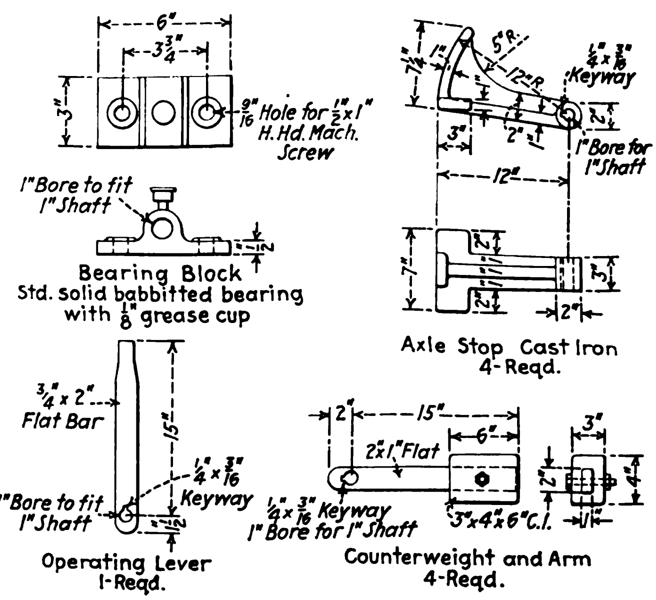
Jack for adjusting the height of the axle rack

the wheel-starting press. The construction of the axle rack located in front of the wheel-starting press is shown in one of the drawings. Two other racks for unmounted wheels, also shown, are located in a convenient position for handling the wheels to the adjustable section of the rack.

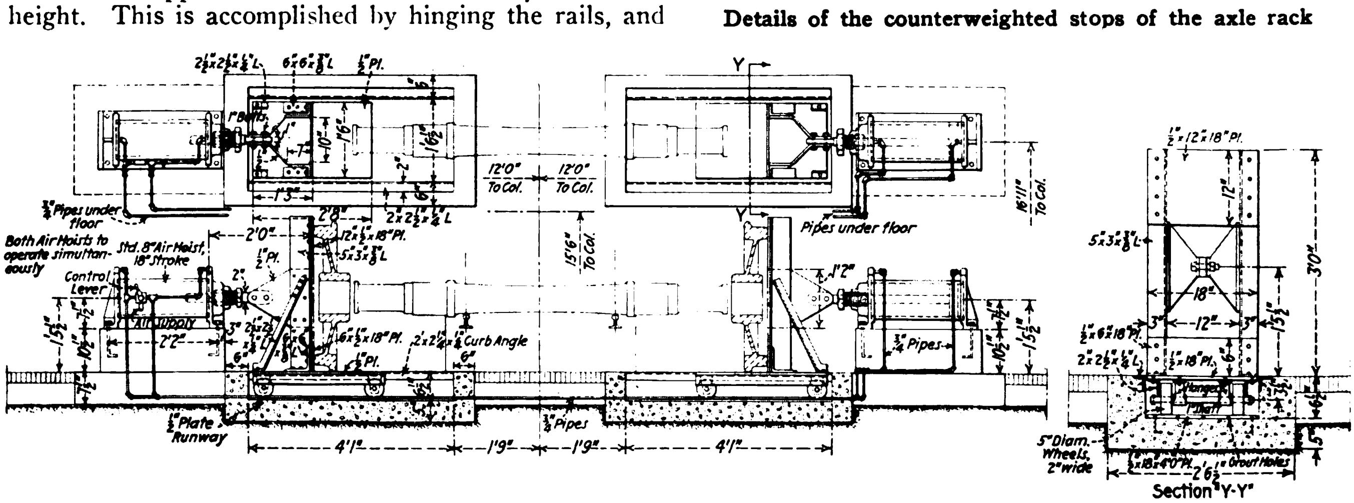
Axles are rolled from the truck directly on to the rack. The opposite end of the rack is adjustable for height. This is accomplished by hinging the rails, and providing two small jacks, the construction of which is also shown, under each rail. Four counterweighted stops are provided, two of which prevent the axles from rolling from the rack onto the adjustable section until required, and two prevent the axle from rolling off the rails. The adjustable section of the rack is adjusted so that the ends of the axle to which the wheels are to be applied are directly opposite the wheel bores.

The rack for unmounted wheels is designed to facilitate the handling of wheels from either side with a minimum of effort. It is constructed of ½-in. by 2¼-in. steel bar, the guide bars being spaced 8¼ in. apart. A bar on which each wheel rests is provided in each space. This bar protects the flange and tread, keeps the wheel erect, and facilitates the handling of wheels to and from the rack.

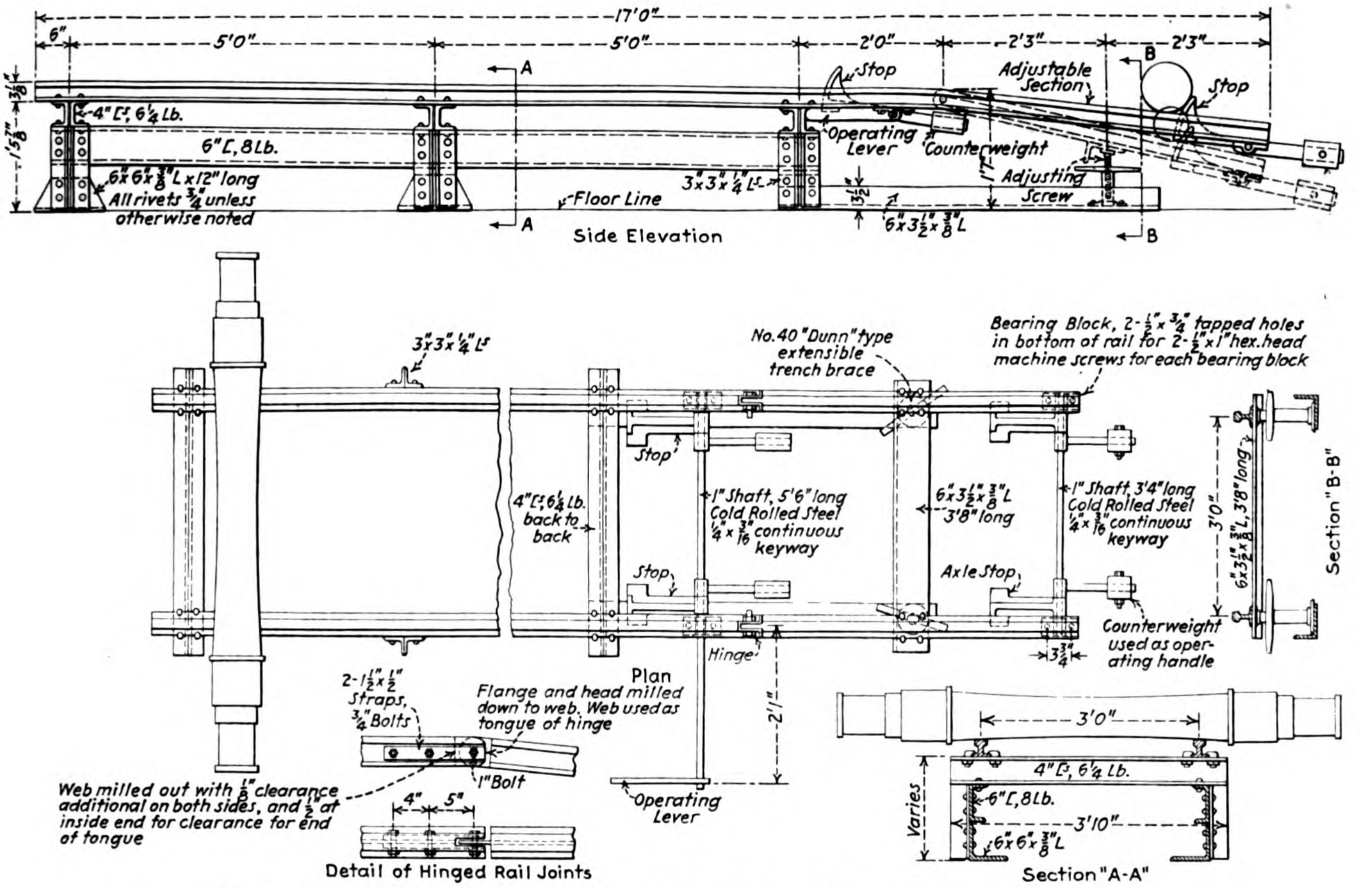
The wheels are placed over the journals of the axle at the rack as described and rolled on to the wheel-starting press, as shown in one of the drawings. The



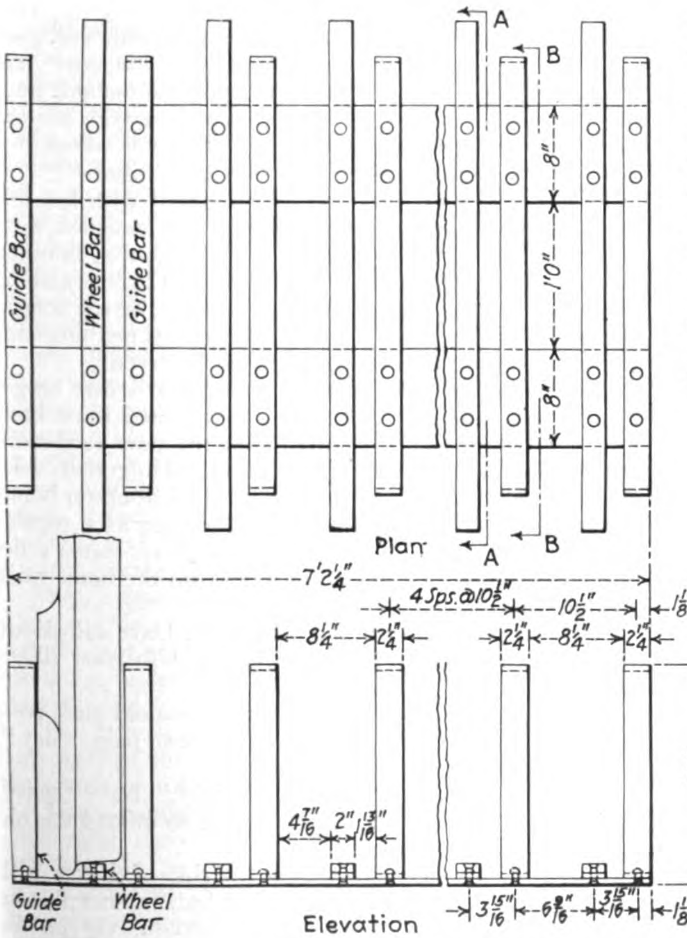
Details of the counterweighted stops of the axle rack



Wheel-starting press showing wheels and axle in position



Detail construction of the axle rack located in front of the wheel starting press

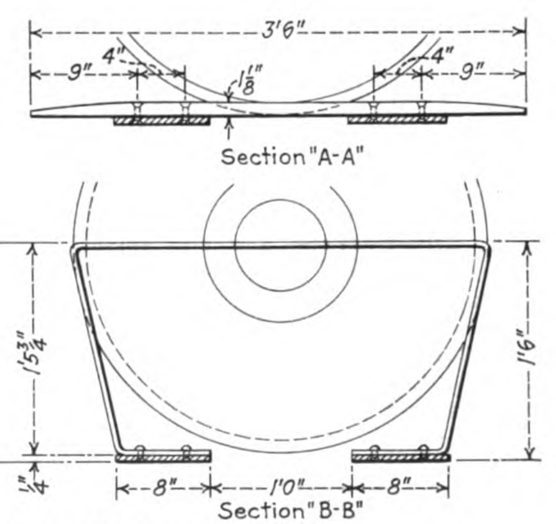


wheels rest on two small trucks which are carried on unflanged wheels that roll on ½-in. steel plates.

Power for the starting press is supplied by two standard 8-in. air-hoist cylinders having an 18-in. stroke. Both cylinders are operated simultaneously by the same control lever. Compressed air is supplied to the cylinders direct from the shop air line.

With the wheels started on their respective seats, they are thence rolled directly into the Niles 400-ton wheel press, where the pressing operation is completed.

The use of the wheel-starter as an intermediate operation in the process of applying wheels saves considerable time at the press, which is always operated near or at its capacity.



Rack for storing unmounted bored wheels awaiting application to the axle

Alec and Dave Discuss A Broken Flange

By T. J. Lewis

Alec cards a car from Dave's road on account of a broken flange. Dave can't see why he should repair it when through an error it is switched to his track

DAVE surely must have seen the new moon through the bushes. At least he has had enough trouble lately to make it seem so. In an inbound train yesterday morning Alec received an empty car belonging to Dave's road which was due to go home through the interchange. Sure, there was nothing out of the ordinary about that, but there was something very much out of the ordinary in the fact that this particular car had a wheel with a broken flange and part missing. Alec found the broken wheel.

As to whether or not there was anything to be considered out of the ordinary in Alec finding the defect would depend on who was doing the considering. Now the master mechanic probably wouldn't see where there was any excuse for an inspector failing to find such a defect if he was giving proper attention to his work. The general car foreman, if he had not been too long out of the inspection game, would be somewhat doubtful; while Alec, if he should have failed to find it and had gotten in a tight place on account of it, would have coupled up to a whole train of good arguments to prove that it was the easiest thing in the world to overlook a broken flange, and right next to the hardest thing to find one. Anyway, he hadn't missed this one, and call it good luck or just ordinary good inspection, as suits you best, Alec mentally patted himself on the back and resolved to be a little more watchful for that particular defect in the future.

Alec put a "Bad Order" card on the car and went on with his work, intending to repair it before offering it home on the interchange, to avoid an argument with Dave. Alec had no desire for an argument with Dave.

Dave is rather hard to argue with and, being very energetic, will go to any amount of trouble to prove that he is right and—Alec says—as much to convince himself as any one else.

There was a new yard clerk on duty in Alec's yard yesterday. Now the yard clerk, be it known, is the bird who waits until the inspector has closed the doors of all empty cars, and then comes along and opens them to see for sure that they are empty and leaves them open for the inspector to close again.

He also has another duty to perform. When a train comes in he takes a pocket full of cards and a mouth full of tacks and goes along the train and puts routing cards and weigh cards, etc., on the cars for the guidance of the switchmen in shifting the train.

Well, yesterday morning when this new man started out to tag up his train he was instructed to remove all old cards from the cars as he applied the new ones, in order to prevent confusion of the switchmen. He did that all right, and he made such a complete job of it that he got Alec's Bad Order card off the car with the crippled wheel. Sure, he was not conscious of having done anything more than his duty and if you engaged him in conversation about his job and listened to him long enough, you would be apt to get the idea that he really thinks he has some troubles of his own. Just the same, he had mixed Alec and Dave and their business just like scrambled eggs with plenty of salt and pepper.

Alec's Bad Order card being gone from the car, the switch crew kicked it in on Dave's interchange track. Dave found it. And when he saw the broken flange, he stopped, took a good look at it, then got down closer and felt the broken surface with his hand, making doubly sure that it was nothing less than the subject of the car inspector's worst dreams, he straightened up and whistled softly to himself. His next thought was "where from and where to." Glancing over the side of the car he saw the "Home Mty" card, then going to the corner he found Alec's pool mark just a week old.

Dave put a "set back" ticket on the car first thing and put a big scare-crow wheel mark on the side of the car, over the defective wheel, with soft chalk, and then looked around for Alec. He soon saw Alec, several car-lengths down the track and coming towards him inspecting as he came. Dave whistled and gave Alec a vigorous "come on" signal with his arm. He intended to give Alec a good "ragging" about not finding the broken flange and then make him take the car back and make it safe by renewing that wheel, for surely he'd never accept it in that condition.

Dave's thoughts were so well occupied with his side of the game that he forgot entirely to consider what Alec might be thinking, but, in truth, Alec was thinking about the same thing Dave was. He had been watching Dave out of the corner of his eye and Dave's actions spoke as plainly as a defect card that something was wrong and that Dave thought he had it "treed."

Alec recognized the crippled wheel car before he got near it and knew that his bad order card must have been removed and had figured that the new yard clerk must have been the one who did it. Altogether, Alec was very well satisfied that the car had gone on home. He expected Dave would object, for he was a regular objector anyway, but let him. It was an owner's defect, on a home car, delivered safely on the home rails, so that was that.

As Alec got within talking distance, Dave called out. "Say, Old Man, what's got the matter with you? Have you lost your cud, or what?"

"Oh, no new complaints, just the same old ones, poor and got to work. Where is your worst pain today?" asked Alec.

"Its on the outside of me, all right," Dave replied, and asked, "What's the idea in trying to unload this old hospital subject on me?"

"Well," said Alec, glancing at the side of the car with the greatest possible appearance of indifference that he could assume, "seems to belong to you, tag on the corner says 'home empty,' and as for it being a hospital

subject, if it is, you being the doctor, and having the hospital, you'll naturally want to operate on it,—I would if it belonged to me."

"Well, it still belongs to you, all right. Just read that little prescription of mine on the other corner over there. And, say," Dave continued, "how many wheels do you require under 'em to run 'em now."

"O, from four up," said Alec, "the scale test car has only four."

"Well, this baby's got seven and a piece, and I'm not running it anywhere," Dave said, and continued, pointing at the broken flange, "just look here, Alec. How in the world did you miss seeing that or did you?"

Alec looked at the flange as if that was the first time he had seen it and said, "Huh, chipped, aint it?" His seeming indifference was beginning to get on Dave's nerves and Dave was getting hot. He snorted:

"Chipped, the devil! You want to call half the flange a chip, do you? Now let me tell you Alec, there's no use trying to start that soft pedal stuff, for it won't go. Get that straight, now. And the car is coming back to you, remember that."

"Why, Dave, you haven't a right in the rule book to set that car back. I had ordered it to my rip track when it came in, with all good intentions of repairing it before it was offered home to you, but someone has removed my ticket and now its yours," Alec said, adding, "Anyway, there's only a foot of the flange gone."

"Say- - - -" Dave's voice was low but vibrant with suppressed emotion, "What'll you take for that silk lined plan of yours for getting rid of things you don't want? All you got to do is just say 'let Dave do it' and, presto it's done and you are out from under. Why you've got that lamp-rubbing guy skint ten car-lengths." Dave was looking at Alec with about the same amount of contempt that Mr. Goliath must have looked at David when David accepted his challenge to that famous scrap.

Before Alec could get started, Dave continued, "And as for what rights I've got in the rule book, I've got a right to refuse any car that I don't consider safe to handle and I sure don't consider this one safe, neither do you. It's just too much of a risk to handle all the way from here to my rip-track—"

"Yes, but Dave," Alec cut in, "every car you handle is more or less a risk and if you don't take any risks you don't do any business, and if you don't, somebody else will. If you wanted to avoid that, you should have stayed in the back shop at North Yard, then you'd only have your day's work to do, and you wouldn't dream about dragging brake beams and loose wheels. Of course, when you think about being responsible for the safety of a few thousand tons of freight and equipment, whirling through the country at forty miles an hour, it feels pretty much like its on your shoulders, but that and your pay-check is what you get for being a car inspector—."

"Yes, a mighty fine bunch of Dr. Alec's soft soap," Dave cut in, "but it ain't making me forget this old cripple, not a blame bit. You just read the first interpretation under Rule 2. That's the ground I stand on and its solid."

"Oh, I know, Dave, it says that Rule 2 gives the receiving line the right to refuse any car which in its judgment is not safe for movement on its line, but—"

"That's enough! That's plenty!" Dave cut in, "Just stop right there. That's just what I'm turning this car down on, and I've done it already, good and flat—"

"O, dammit, Dave," Alec almost yelled. Alec was becoming excited himself. "You can act the blamedest fool I ever saw. You grab a half a fact and yonder you go with it, to beat a printer's devil. That statement is in an interpretation and it is not in the rule at all and the rule is what we've got to go by. That same interpretation itself goes on to say that it concerns a defective weld in a truck side—no mention is made of a wheel."

"It don't make a blame bit of difference—" Dave got started again,—"which it is in. The interpretations are only supposed to be a clarifying of the rules, and that one says right there that I've got a right to refuse any car that's unsafe, or that I consider unsafe; all said in one clean cut sentence with a period after it and it means just what it says or it don't mean anything and if it didn't mean anything it wouldn't be there. Now there's no way in the world that you can get around that. It says, furthermore, that I'm to use my own judgment."

"All of which sounds mighty convincing to you, of course, but, in the first place, the makers of the rules were generous enough to suppose that you had judgment to use and, in the second place, Buddie, just turn back there to page 11 and read the third paragraph of Rule 2. You see it says, 'Owners must receive their own cars home for repairs at any point on their line, subject to the provisions of these rules.' Now I guess that cooks your goose good and plenty." Alec said this last with a finality that he intended should close the subject forever, but surely he should have known his old yokemate better than that, for Dave jumped right at the bait he had hung out, thiswise:

"Yes, that's it; just wait a minute right there; that last phrase of that paragraph, 'subject to the provisions of these rules,' why, Alec, that was put there to take care of just such old patients as this one you're trying to dump on me now."

"Not dumping anything," said Alec, "gave it to you in regular switching order, on its own wheels; and for that last phrase of the third paragraph of Rule 2, there is no provision in the rules that you could ring in on this case except wrong repairs, or unfair usage, or defective safety appliances, neither of which you claim. It's simply your own car delivered home on your own rails with an owner's defect. It's yours, you've got it and you can keep it—that's all."

"Give it to me safe and I'll take it," said Dave, "like it is I won't."

While they were in the argument, Dave's switch engine crew had set in a small bunch of empties on Alec's track and coupled up to pull their own, and began backing out with them at this juncture. Alec and Dave both involuntarily started with the cars. Neither one had given over, and it was not clear to either of them just what the next phase of the matter would be. Dave gave a stop signal several times but none of the crew saw him. They both realized that they should have made provisions against this car being pulled until it was definitely decided what to do with it, then have it moved very slowly and carefully to a rip track. Also it was not the usual time for pulling the interchange, and they were not expecting it. The broken wheel had been the rear wheel of the truck as the train came in, but now it was the lead and, of course, this made its staying on the rail extremely doubtful. They were both on edge, watching the defective wheel and Dave kept giving stop signals and hoping he would be seen. By this time the car had struck the beginning of the curve near the switch, the sharp end of the broken flange caught the rail and off it went onto the ties.

Then Dave went into action of the first magnitude. He gave "washout" signals with both arms and both legs so fast that he looked like a monstrous pair of scis-

sors hitting on six in high, and talk about cussin' by note! Dave's voice sounded like a buck dancer doing his stuff on the bass notes of a calliope. Meantime, the old car was thumping along on the cross-ties and getting nearer the end of them every foot. In his desperation or in the hope of making his signals more emphatic, Dave grabbed his hat in his hand and used it as a flag, and as he waved it wildly, a nail protruding from the side of the car split it wide open and took the skin off his knuckle at the same time. He didn't notice the skin until later. Finally, after what seemed ages to Dave, the switch crew noticed that something was wrong in the rear and got the engineman to stop as quickly as possible. But just as they came to a stop the derailed wheel dropped off the end of the ties and the old car careened over and the corner of it smashed a big hole in the side of one of Alec's empties that Dave's crew had just delivered.

It was plain enough all Dave's trouble now. Alec felt somewhat guilty, though he reasoned that it was none of his fault. Dave stopped and just stood there, his face turning all sorts of colors, shading off from one to the other. He was so mad he would not attempt to speak. After a few seconds he slowly walked across a couple of tracks and sat down on the end of a cross-tie and when Alec finally spoke Dave didn't even tell him who to go to.

It will take at least thirty days or a pay-day to make Dave quit wanting to murder Alec.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Insufficient Information on Car Damaged Under Rule 44

Manufacturers Railway Company car 5067 was damaged on or about April 16, 1929, and was repaired by the Texas & New Orleans at Ennis, Texas, September 17, 1929. The defects were claimed to be both old and new and the T.&N.O. billed the owner for repairing the old defects. The handling line stated that the car was loaded when it was delivered to it at Fort Worth, Texas, on April 16, 1929, and that a subsequent inspection showed that one side and intermediate sill, both metal body bolsters and body-bolster anchor straps were all broken, and were classified as old defects. The new damage consisted mainly of the other four longitudinal sills being broken. The handling line stated that it made every effort to develop the circumstances surrounding the cause of the new defects, but was unable to do so. In view of this fact it accepted the responsibility for the new damage as provided for in A.R.A. Rule 44. It contended, however, that the old defects existed before the new damage occurred, and that the owner should be billed for repairing the old defects in accordance with Rule 41. The owner contended that the T.&N.O. should carry the expense of all the repairs made, because they were unable to explain the circumstances surrounding the cause of the damage as required by Rule 44. The owner also pointed out that after the alleged damage occurred on April 16, 1929, the car was moved a distance of approximately one thousand miles before it was repaired on September 17, 1929. The owner brought out the fact that on May 24, 1929, the T.&N.O. reported the car under Rule 120, at which time it furnished a statement of the defects which did not enumerate whether they were new or old, but which it insisted was a condition which had been built up progressively by normal wear. As the car was reported under Rule 120, and since six broken sills were involved, resulting in a Rule 44 condition, the owner insisted under an explanation of the circumstances under which the car was damaged, but pointed out that the T.&N.O. was unable to furnish it.

The following is the decision of the Arbitration Committee: "Handling line has failed to furnish sufficient evidence to establish responsibility of car owner for the combination damage on basis of Rule 44. Rule 41 does not apply to such case. Handling line is responsible."—*Case No. 1659—Manufacturers Railway vs. Texas New Orleans.*

Defect Card For Boring Holes in Gondola Sides

Between July, 1926, and April, 1927, the Chicago & Alton received in interchange from the Elgin, Joliet & Eastern five gondolas in the sides of which holes were bored for securing lading. These cars were owned by the Missouri Pacific, the Minneapolis & St. Louis, the St. Louis-San Francisco, the Southern and the C. & A. When the cars were received in interchange defect cards were granted the C. & A. covering the holes bored in the siding. Each of the respective car owners repaired its car and rendered a bill against the E. J. & E. covering the repairs. The chief interchange inspector at Chicago issued offset defect cards against the C. & A. The C. & A. contended that A. R. A. Rule 32 (of the 1926 code), supported the issuance of the original defect cards, and stated that it was carded for similar defects at other terminals, and that they therefore had to protect themselves when receiving cars. The C. & A. also maintained that reference to Rule 4, paragraph 3, in support of the action of the chief interchange inspector as covered by File AC-1976-D, April 1, 1929, did not appear to be sustained in Arbitration Case 1516 which reads: "Rule 4 is intended to prohibit the issuance of defect cards for slight damage, that of itself does not require repairs before reloading the car, and is a measure for the guidance of inspectors in determination of responsibility, and should not be used for the purpose of invalidating a defect card issued in good faith and under the provision of the rules." The C. & A. stated further that it did not admit the original defect cards were issued in error, and further maintained that if they were in error, there could be no good reason why the car owner should not be held responsible, if the defects are considered car owners'. The C. & A. further contended that it did not damage any of the cars and should not be held liable for the cost of repairs.

The following decision as rendered by the Arbitration Committee: "That portion of Rule 32 of the 1926 and 1927 Codes, reading 'Removal or cutting out parts of car to facilitate loading and unloading,' was not intended to penalize delivering line for holes bored in sides of gondola cars to comply with A. R. A. Loading Rules requirements, and the rule was therefore amended in 1928 to definitely so indicate.

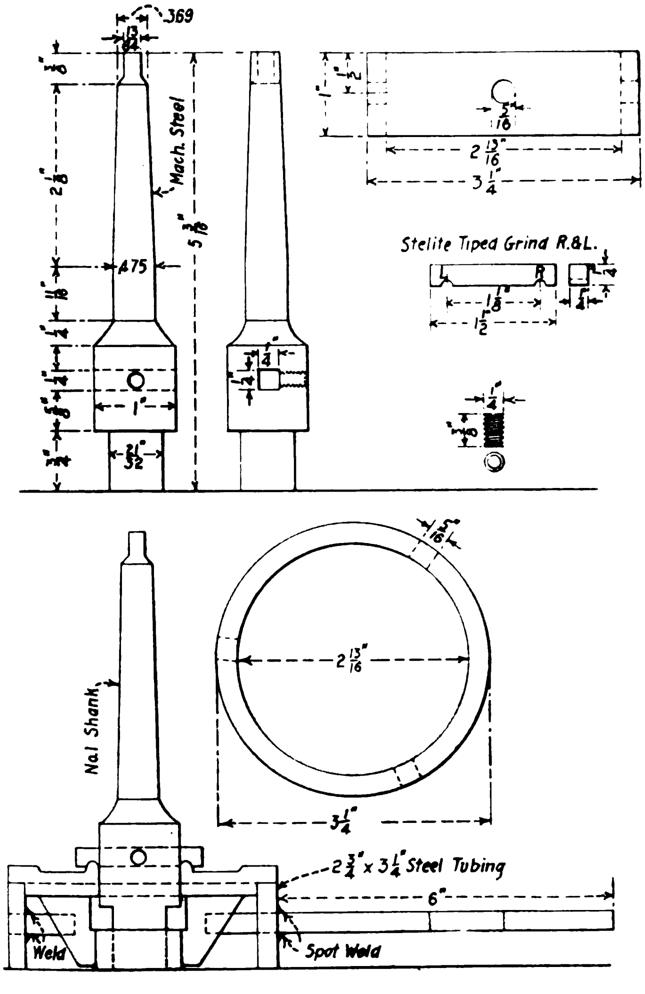
"The A. R. A. Loading Rules are a part of the Inter-

change Code, as stated in preface of the latter, and it would be inconsistent to penalize delivering line under the Interchange Code for doing what is required of it under the Loading Rules Section of the same Code.

"The issuance of a defect card by an authorized representative of a railroad is an acknowledgement of responsibility by the company issuing same which cannot be repudiated and leaves no ground for arbitration before the Arbitration Committee."—*Case No. 1660—Ex Parte Case—Chicago & Alton.*

Emergency-Valve Reseating Tool

A TOOL for renewing the emergency-valve seats of K1 and K2 triple valves is shown in the drawing. The tool was designed to eliminate the practice of attempting to reseat the valve with emery cloth since this



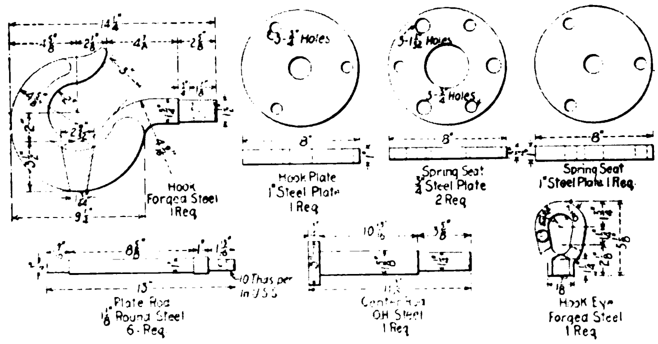
A tool for renewing emergency-valve seats of K1 and K2 triple valves

practice left the seat flat on the top instead of round, thus making it difficult to secure an air-tight joint when the rubber seat is applied.

When using the tool the emergency valve is placed in a holder and the tool is inserted in the spindle of a drill press, which is run at a speed of 100 r.p.m. The tool guide is entered in the valve and the tool permitted to run against the seat for a few revolutions until it is trued up.

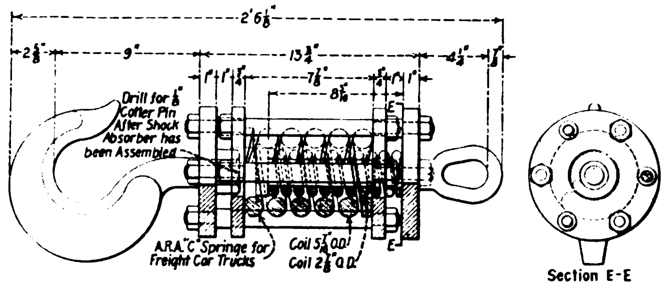
Shock Absorber for Five-Ton Jib Crane

THE shock absorber shown in the two drawings, is designed for 5-ton jib cranes. Shocks are absorbed by a single nest of class *C* A.R.A. truck springs. The coils are held in place by two circular



Details of the five-ton shock absorber

steel spring seats. The shock absorber is assembled by securing the hook plate to the top of the hook by means of a 1½-in. nut, which is held in place by a ⅛-in. cotter pin. The top spring seat, which holds the inner coil in compression against the bottom seat, is secured to the center rod by the hook eye. The top seat for the outer



The shock absorber for five-ton capacity jib cranes

spring coil and the outer spring are applied and the seat is secured to the hook plate by three plate rods. Three 1 1/32-in. holes are drilled in the top spring seat for the outer coil for the 1-in. plate rods connecting the hook plate to the seat. The outer spring coil carries the load, and the inner spring serves to cushion any upward movement.

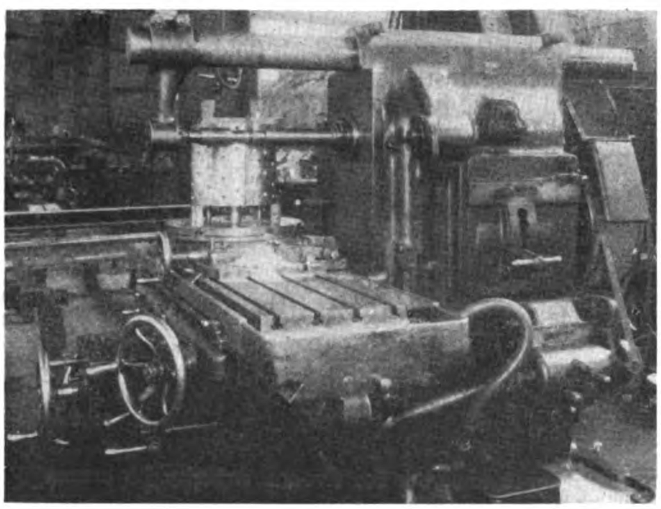
BERTH OF A NATION IMPERILED.—Bedroom compartment cars, replacing old-fashion sleepers, threaten to put the upper-berth snoring champion on the shelf. New traveling boudoirs for tired business boys have all modern conveniences, including liquid soap, cozy reading lamps, chummy drafts and—to face towel kidnapers—hot and cold conscience twinges. There are also numerous little extras, the most amusing being the extra fare. Somehow we harbor an old-fashioned prejudice against the new hall room sleeping car. Modern luxuries creeping into our railroad systems may sap the ruggedness of the Yankee race, which thus far has been able to disrobe in a curtained chicken coop, remove its shoes while teetering on its collar bone, and get into its pyjamas like a democratic majority crashing a republican precinct. The American spirit, which conquered upper berths and Big Berthas, may lanquish when sleeping cars go kitchenette. While enjoying our modern blessings, let us not underrate the incentive to climb as a stimulus to human advancement.—Chicago Daily News.

In the

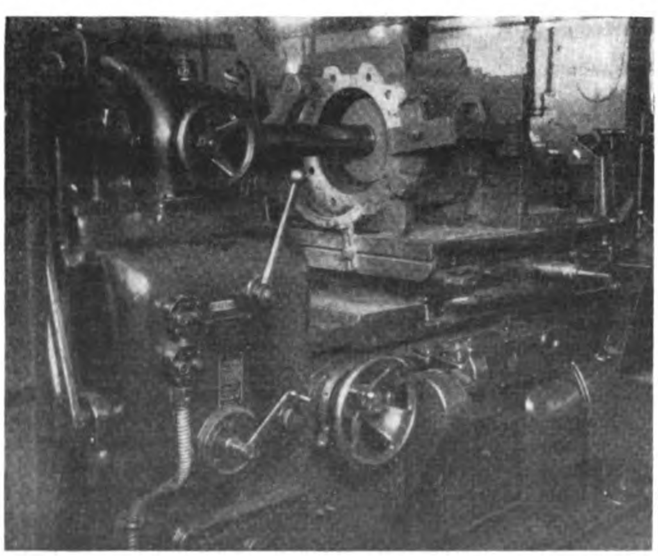
Back Shop and Enginehouse

Applying Floating Driving-Box Bearings

FOR about a year, the Chicago, Burlington & Quincy has been using floating bushing driving boxes on all except the main driving journals of heavy passenger power, these main bearings being equipped with Grisco boxes. To install a floating bushing in a driving box, the old cellar is simply removed and the driving box slotted to receive a cellar filling block which is held in place by suitable shoulders and two cellar bolts. The driving box is faced off to receive a grease-retaining plate with a spring-supported brass expanding ring, which fits the journal closely and serves to retain the grease. The driving box, as well as the cellar filling block, is provided with grease cavities and drilled and tapped for the application of Alemite fittings with ports leading to the grease cavities. The fittings are screwed into the box and filling block and then spot-welded to make sure that they will stay in place. The proper side play is assured by welding on boiler-steel plates and facing off to the required thickness. Shoe and wedge ways are also built up to standard blue-print dimensions in the same manner. Spring saddle seats are built up by electric welding and machined square and at the proper height from the axle center.

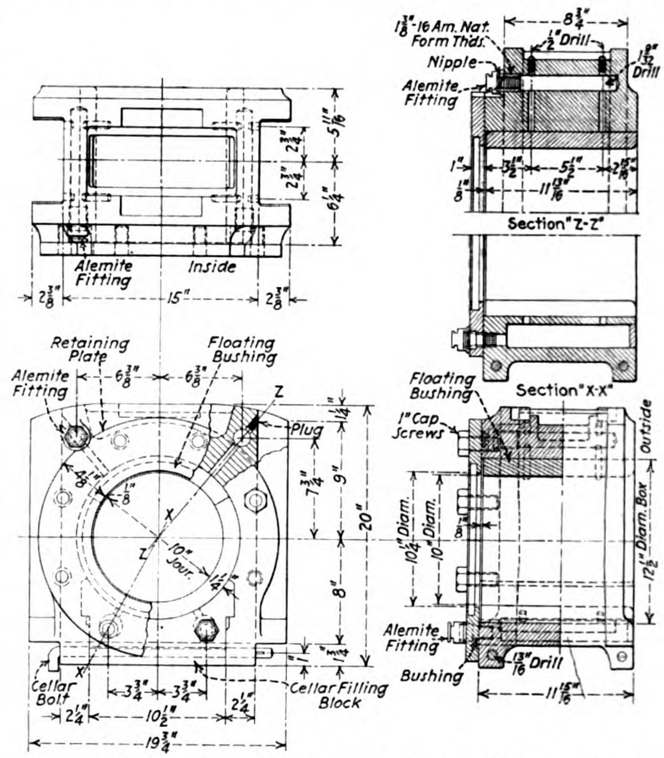


Sawing the finished floating bushing into three equal sectors for assembly around the journal in the driving box



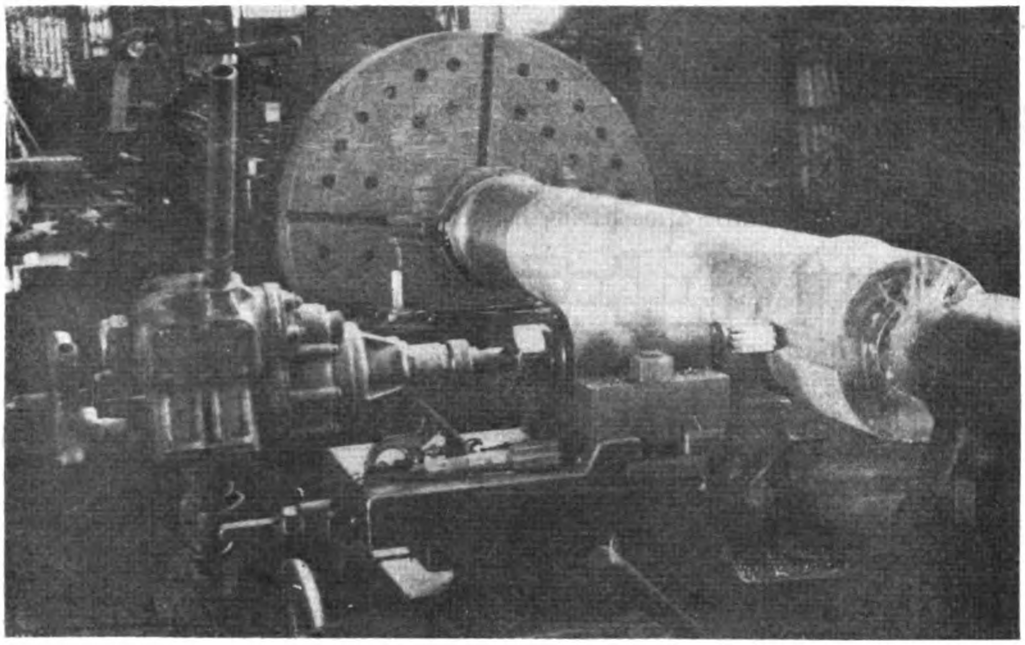
Driving box, with filling block applied, being ground round and straight for the application of a floating bushing

The inside surface of the assembled driving box and filling block is then bored to the proper size and ground



10-in. by 12-in. driving box with floating bushing application

accurately round and straight on the Micro internal-grinding machine. The bronze bushing, made in one piece from a tub cast in the Burlington brass foundry at Aurora, Ill., is machined .002 in. larger than the journal diameter and .030 less than the inside bore of the driving box. These clearances make due allowance for expansion and a substantial film of grease lubricant. The bronze bushing, after being machined on a 36-in. Bullard vertical turret lathe, is drilled and counter-bored for grease holes, then being sawed into three equal sectors on a Brown & Sharpe knee-type miller, as shown in the illustration. The saw used is 1/8 in. thick; therefore, the total play of the three-piece bushing around the journal is 3/8 in., this space, as well as all the counterbored holes and all clearance space, being filled with grease by means of grease gun application to the Alemite fittings. Substantially greater service life is secured with this type of bearing as well as freedom from hot boxes and attendant difficulties in heavy, high-speed passenger service.



A milling device which is attached to the carriage of the engine lathe for cutting axle keyways without removing the axle from the lathe after it is turned to size

Cutting Keyways In Driving Axles

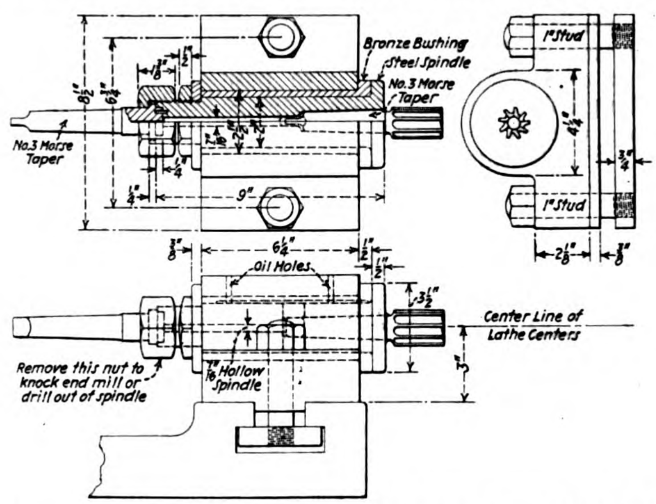
IN the drawings and photograph is shown a milling device for cutting keyways in the wheel fits of axles and also for the eccentrics of the Stephenson Valve gear. The device is mounted on the carriage of the engine lathe on which the axle is turned, thus permitting the milling of all the keyways before the axle is removed from the lathe.

In laying out the keyways the face plate or chuck is first quartered in the usual manner and the proper points transferred to the axle by using a surface gage for catching the points and a sharp tool or pointer in the tool post for marking the axle. This center line is also marked on the axle at the point where the eccentrics are to be placed, if it is the main axle and Stephenson valve gear is used.

In laying out eccentric keyways allowance is made for the actual amount of outside lap and the desired lead, taking into consideration the difference, if any, in the lengths of the rocker arms. In actual practice it is neccessary to add to this a small amount for the lost motion in the valve gear, this amount varying from a full thirty-second to possibly a full sixteenth of an inch, depending, of course, on the condition of the valve gear.

After the keyways are laid out, the axle, still on the centers, is clamped to the bed of the lathe to prevent it from moving. The end mill, attached to the lathe carriage, is used for cutting the keyways, an air motor being used to drive it. The desired feed of the milling tool is obtained by running the lathe and setting the feed of the carriage to suit. In cutting the keyways for the eccentrics, the end mill may be removed and a drill of proper size substituted for cutting the clearance for starting the milling tool.

If the keyways in the wheel are carefully checked and the keyways in the axle cut accordingly, the crank pins will be in perfect quarter when wheels are pressed on. If the same care is exercised in checking and laying out the eccentric keyways, the eccentrics may be keyed in position before placing the wheels under the engine with the assurance that it will seldom be necessary to change an eccentric when setting the valves.



The milling device for cutting the keyways mounted on the lathe carriage

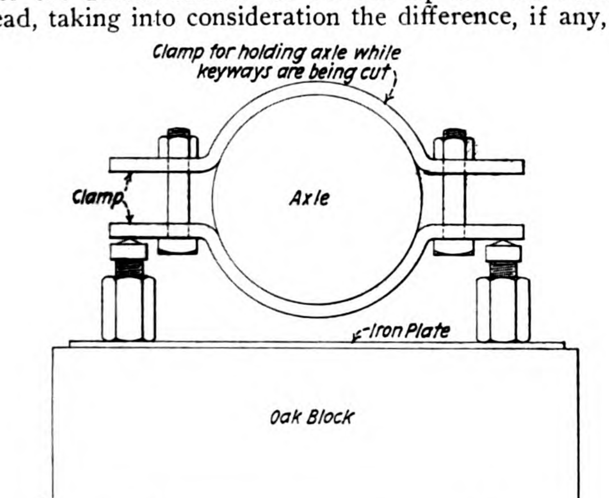
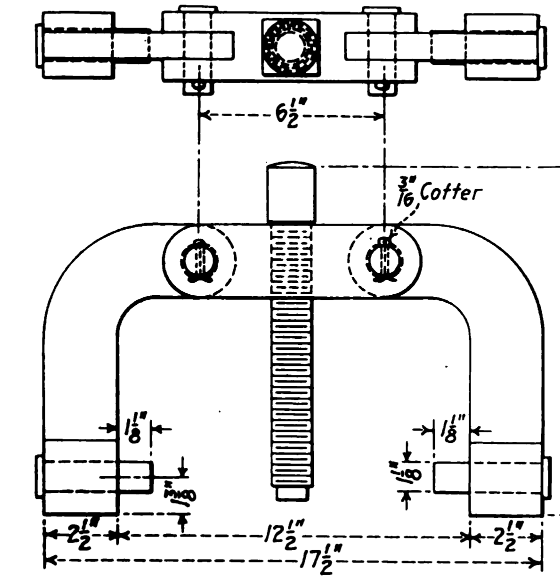


Table for laying out the keyways on the axles—The clamp for holding the axle while the keyways are being cut is shown

Eccentric-Crank Pullers

In the two drawings are shown two types of pullers which can be used effectively for removing eccentric-crank arms. The one is 17½ in. long, 12½ in. wide between the pulling arms and 12½ in. high and is designed for use on eccentric arms having bolt holes in the center of the hub. It is fitted with 1⅛-in. pins for inserting in the bolt hole and is designed with hinged arms to facilitate setting it in position. The 1¼-in. pulling bolt is machined with a square head for use with a box wrench.



An eccentric-arm puller designed for use on arms with holes at the center of the eccentric-arm hub

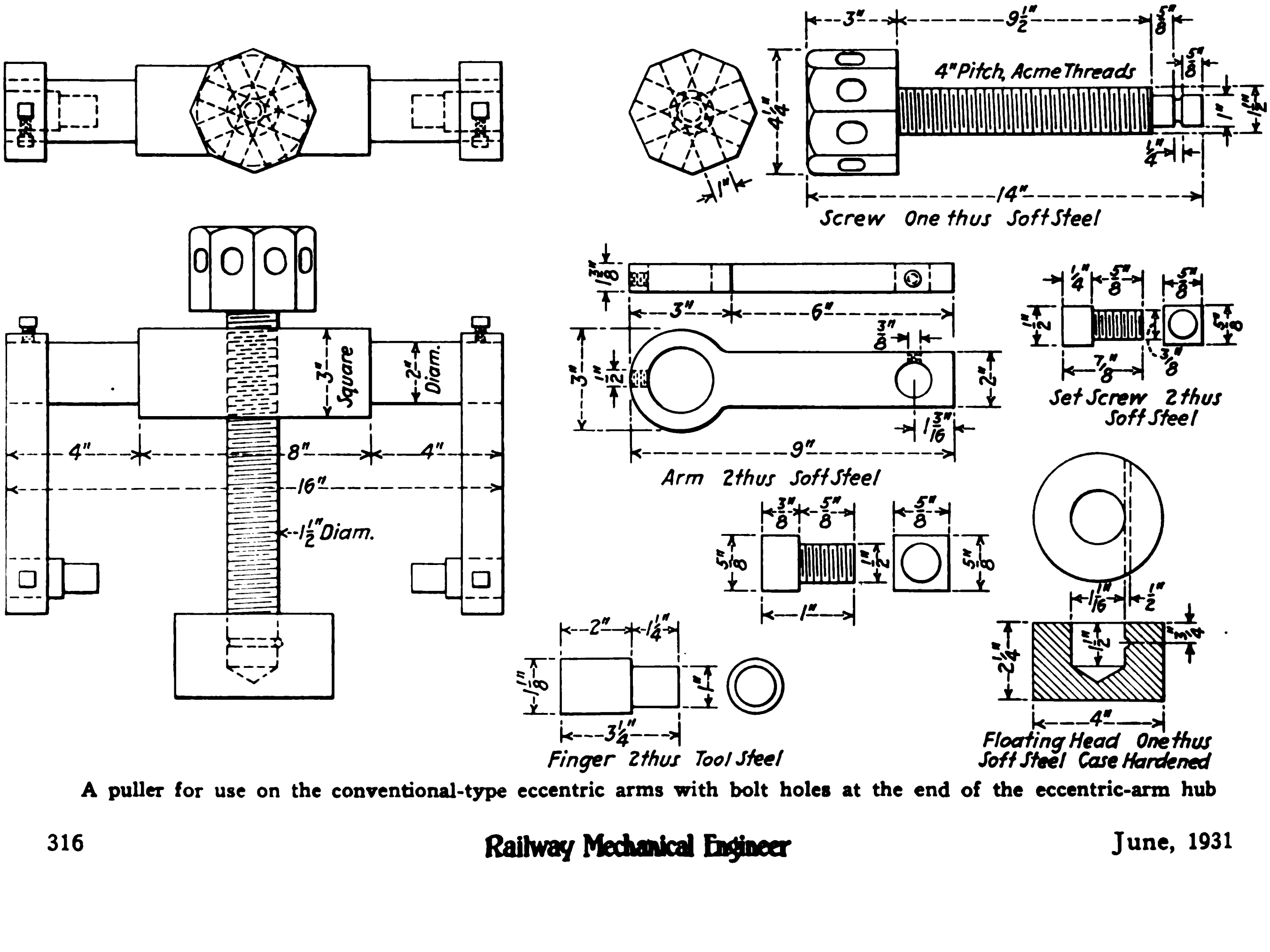
The puller fitted with a 2¼-in. by 4-in. diameter floating head set at the end of the pulling bolt is designed for removing eccentric arms with bolt holes at the end of the eccentric-arm hub. This puller is 16 in. wide and is fitted with a 1½-in. bolt. The arms of the puller are of 1⅜-in. by 2-in. soft steel and are bored to a diameter of 2 in. at one end for fitting them to the cross arm of the puller. They are held in position on the cross arm by means of ½-in. set screws. The fingers, which fit in the arms and which are inserted in the bolt holes, are 3¼-in. long, machined to a diameter of 1⅛-in. for a distance of 2 in. for fitting in the arms and to a diameter of 1-in. for a length of 1¼ in. for fitting in the bolt holes.

Air-Motor Drive For 100-Ton Norton Jack

Shown in the three drawings are the details and assembly of an air-motor drive designed for use with a 100-ton Norton jack. It can be used with one or two jacks. In case the latter arrangement is used a 24-in. extension shaft is provided. This shaft has sockets at both ends to fit a No. 4 Morse taper shank. Shanks are also provided, as shown, to fit the mandrel of the air motor.

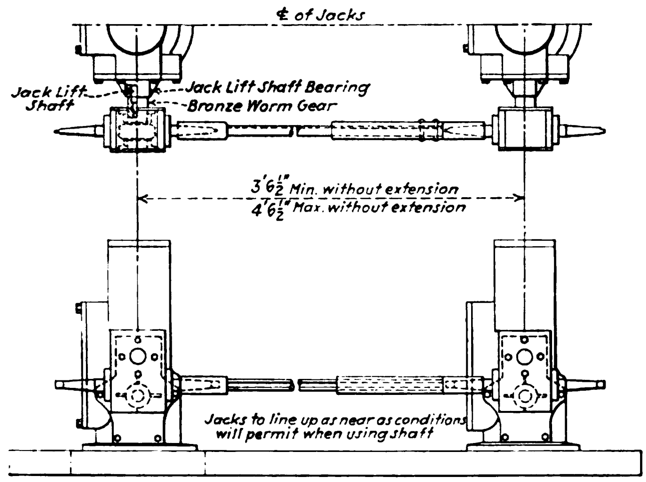
The air motor drives a bronze worm gear which in turn drives a pinion gear keyed to the crank-handle shaft of the jack. Each gear box is provided with two No. 4 Morse taper shanks which project on either side. The air motor or extension shaft can be applied to either shank as is most convenient.

The extension shaft has an adjustable range of 12 in., with a minimum length of 2 ft. 8 in. when closed and a maximum of 3 ft. 8 in. when open. The sleeve is made of 2-in. seamless steel tubing while the shaft is of round steel, machined to a diameter of 1.249 in. A 3/16-in by ⅜-in. keyway, 17½ in. long is slotted along the shaft. A 4-in. key secures the shaft to the sleeve and prevents the shaft from turning in the sleeve.



A puller for use on the conventional-type eccentric arms with bolt holes at the end of the eccentric-arm hub

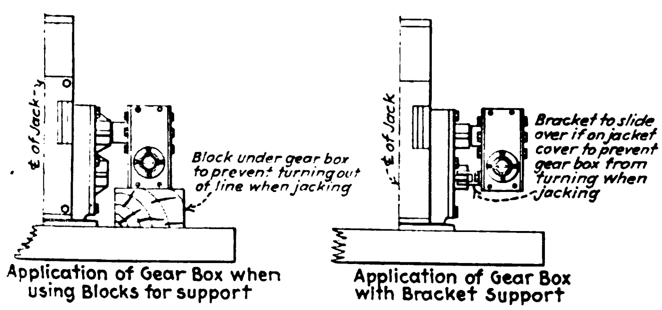
As shown in one of the drawings, the gear box may be applied to the jack with either a wood block for support or a bracket support. The detail construction of the bracket support is shown at the upper right



Two jacks coupled for power drive from one air-motor

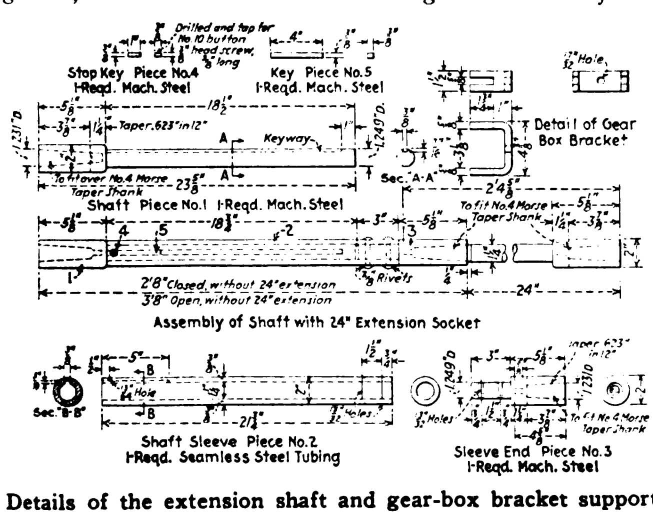
of the drawing showing the details of the extension shaft.

This air-motor drive has been successfully used for the past five years. The arrangement is such as to



Applications of the gear box to the jack

facilitate the use of the jacks for practically all kinds of work where jacks of high lifting capacity are required. The fact that the air motor can be used on either side of the jack, or with two jacks coupled together, has been a distinct advantage. The two jacks

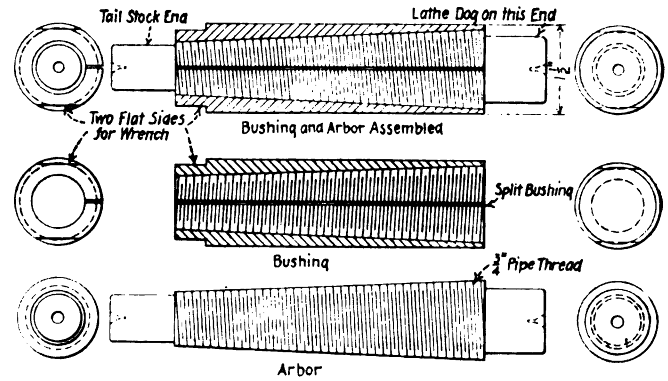


Details of the extension shaft and gear-box bracket support

coupled together with the extension shaft and driven by the same motor insures uniform lifting and lowering, a feature which is important in many instances.

Arbor with A Tapered Expander

THE expanding arbor shown in the illustration is designed with a tapered expander and a split outside sleeve, both fitted with ¾-in. pipe threads. When placing work on the arbor, the sleeve is inserted with the hollow piece to be machined and the tapered expander turned within the sleeve, the tightening of the expander exerting the necessary pressure to hold the work secure.



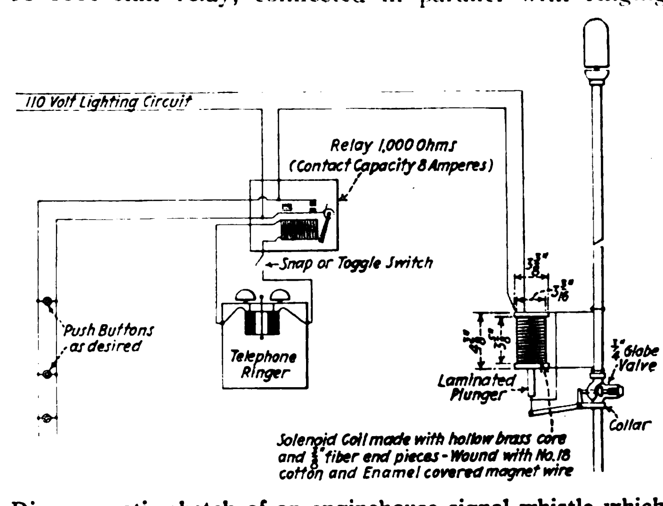
The arbor is designed with a split outside bushing and a tapered expander fitted with ¾-in. pipe threads

The large end of the tapered expander is placed toward the chuck-end of the lathe, thus creating a tendency to keep the work tight on the arbor while the machining operations are being completed.

The sleeve is machined with two flat sides on the end adjacent to the tail stock to permit the application of a wrench, which can be set against the lathe bed to facilitate tightening the arbor when setting the work and loosening it when the work is completed. The arbor illustrated is made with an outside diameter of 1½ in. Smaller sizes necessarily have less taper than the one shown.

An Enginehouse Signal Whistle

THE accompanying illustration shows an electric circuit designed to blow a signal whistle whenever the enginehouse foreman is wanted on the telephone. The apparatus consists essentially of two parts: A 1000-ohm relay, connected in parallel with ringing



Diagrammatic sketch of an enginehouse signal whistle which blows when the office telephone rings

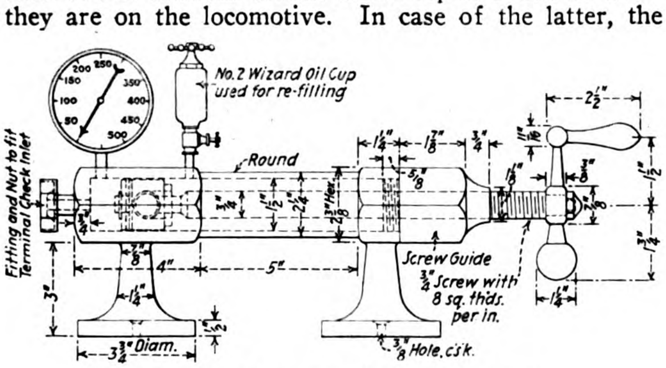
coils of the telephone and a solenoid for the operation of the valve in the air line. The armature of the relay is equipped with a roller on its free end and when the relay is energized, as it would be when current is applied to the ringer, this roller raises the lower member of a pair of contacts, thus closing the 110 volt circuit to the solenoid. A switch placed in the circuit between the telephone ringer and the relay permits the relay to be cut in or out as desired.

It will also be noted that there are a number of push buttons connected in parallel with the relay contacts. These push buttons may be located at convenient points throughout the enginehouse and they provide a means for blowing the whistle, independently of the telephone ringer, from several different points. Their operation is entirely independent from that of the relay. By arranging a whistle code it is possible to summon hostlers, callers, mechanics and other employees at any time by simply pushing one of the push buttons. The whistle used is operated by air and can be heard for more than a mile.

Terminal-Check Tester For Nathan Lubricators

By E. G. Jones

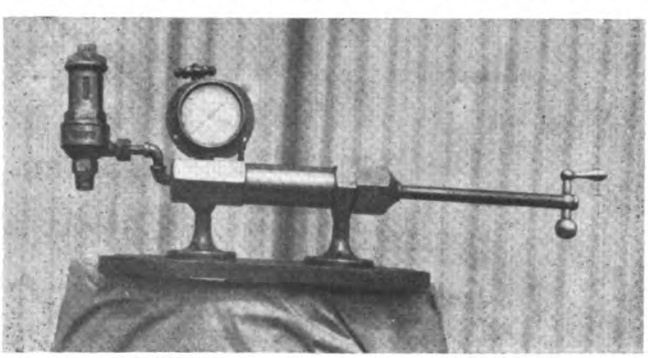
THE tester shown in the drawing is made to test and set Nathan terminal checks. This device can be used to test terminal checks at the repair bench or while they are on the locomotive. In case of the latter, the



Assembly of the terminal-check tester

pipes are disconnected and the tester connected to the inlet connection.

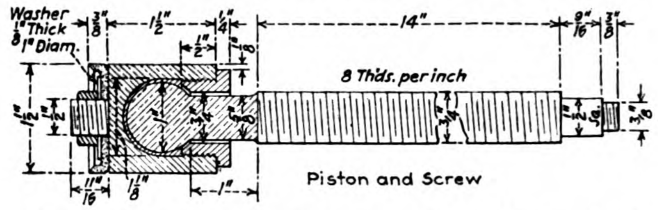
The tester is of sufficient size and design to produce ideal conditions while testing the checks. The barrel is filled by pouring a heavy gas-engine oil into the Wizard oil cup and sucking the oil in by turning the screw piston. When the barrel is full the filling cup is closed and the oil is forced into the terminal check by the screw piston.



Terminal-check tester for Nathan lubricators

The pressure on the gage is noted and the proper setting of the check is made. The check diaphragm valve can be tested for leakage by noting the fall on the pressure gage.

The tester is made of brass, mounted on a small wood

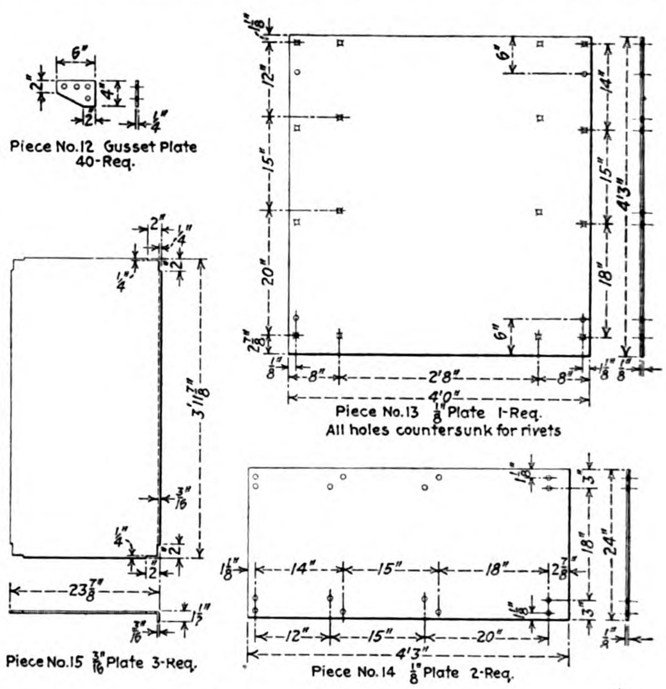


Section of the piston and screw used on the terminal-check tester

base to permit easy handling from place to place. The gage and oil-filling cup should be placed near the extreme end.

Rack for Morton Shaper Attachments

RAILROAD shops with one or more Morton draw-cut shapers have found it expedient to develop a variety of tools, jigs and fixtures for use with the machine. The shops in which the rack shown in the drawing is used, has developed or purchased 42 different tools and attachments to handle the work going

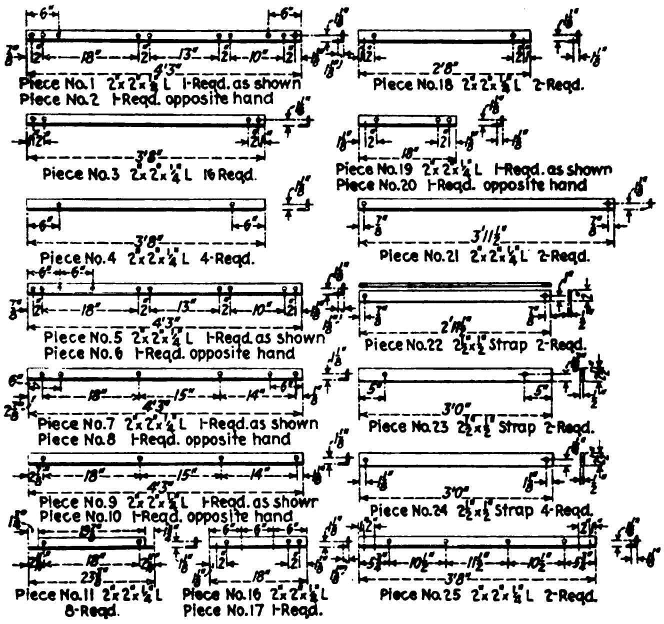


Door and side plates

through the shop on which a draw-cut shaper performs one or more operations.

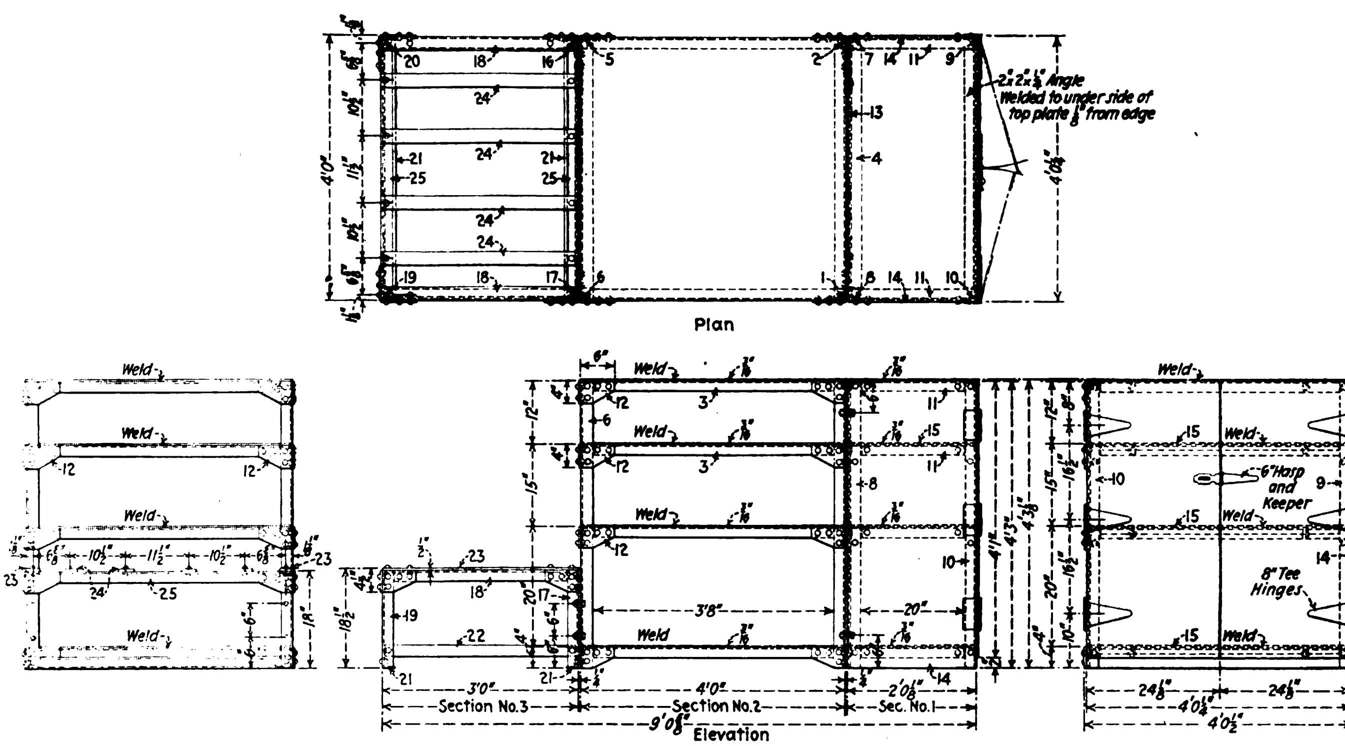
The list includes a connecting-rod brass planing attachment, driving-box shoe and wedge planing attachment, shell or crown-brass planing attachment, swivel-base vise, extension angle bracket and binders for machining the shoe and wedge fit on driving boxes, double chuck with bolts and binder for holding driving boxes, auxiliary adjustable back bearing, standard steel head, double head, large, intermediate and small rotary heads, 18 high-speed tools, special socket wrench for the

rotary heads, four open-end wrenches, three socket wrenches, a hex and flat socket wrench and two straight wrenches. The majority of these items are furnished by the manufacturers of the machine.



Details of the rack

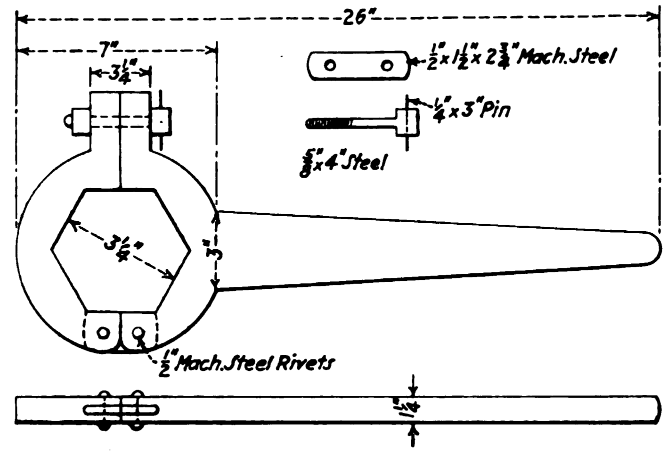
The rack affords a place to put these tools and fixtures in an orderly manner and also provides space for others that may be added from time to time. It is made of $\frac{3}{16}$-in. and ⅛-in. plates with riveted gusset plates for the shelving, welded at the corners, and shelf supports. All holes are punched or drilled $\frac{9}{16}$-in. for ½-in. rivets. All the joints are welded except where rivets are shown. The rack is made in sections which are bolted together with ½-in. machine bolts, 1½ in. long.



Rack for Morton draw-cut shaper attachments

Wrench for Removing Ohio Boiler Checks

In the drawing is shown a wrench which was designed to facilitate the removal of Ohio boiler checks. The method used prior to the adoption of the wrench was to apply a 36-in. Stillson wrench, which usually distorted the boiler-check body and ruined the



A wrench which clamps around the hexagon of a boiler check and removes it without distorting the check body

hexagon points, rendering the check body unfit for further use. In attempting to use an open-end wrench, it invariably slipped and rounded off the hexagon points, making it necessary to resort to the Stillson wrench.

The wrench shown in the drawing, and now used effectively for removing the checks, opens up and clamps around the hexagon part of the boiler check. It starts the check out of the boiler without damaging it in any way. Since its adoption by the road on which it was designed, it has been found unnecessary to scrap any boiler checks which have become distorted on account of attempts to remove them from the boiler.

NEW DEVICES

Production Milling In the Railroad Shop

AMONG the machines especially adapted to railroad shop milling work is the Hydromatic miller, of the Cincinnati Milling Machine Company, Cincinnati, Ohio, which is being used in a number of shops for cutting down production time on driving boxes, shoes and wedges, crosshead shoes and switch plates. The illustrations accompanying this article show some of the applications of this machine to the above classes of work and the fixtures that are used in setting up the different jobs. One railroad shop machines switch plates in quantities on a single-head Hydromatic which, because of the fact that the plates come through in a great variety of sizes and styles, is equipped with a special pneumatic fixture in which the work is slipped under two strap clamps and help by means of a double-acting air cylinder. Switch plates having two rail slots are milled at the rate of 14 pieces an hour.

For milling shoes, wedges and crosshead shoes an eastern railroad has a similar machine fitted with another type of pneumatic clamping fixture. Three milling cutters on this machine finish the inside and outside surfaces of the parts mentioned and for the wedges the fixture is arranged to mill the proper taper in the frame fit. The floor-to-floor time on the average wedge in this shop was reduced from 35 min. to 8 min. and the work is now handled with this single machine and one operator.

Another railroad is using a duplex Hydromatic miller on driving boxes. One of the illustrations shows the machine set up for milling the shoe and wedge fits on a driving box. The fixture is quite simple and is arranged for tilting so as to mill the tapers for the "rock" on the box. The machining time for each box of this type averages 90 min. Worn or repaired boxes are also handled on this type of duplex machine using a similar fixture that will handle two boxes at a time. In the case of repaired boxes only the shoe and wedge faces are milled as the inside surfaces of the flanges do not need to be refinished. The floor-to-floor time for this operation averages 17 min.

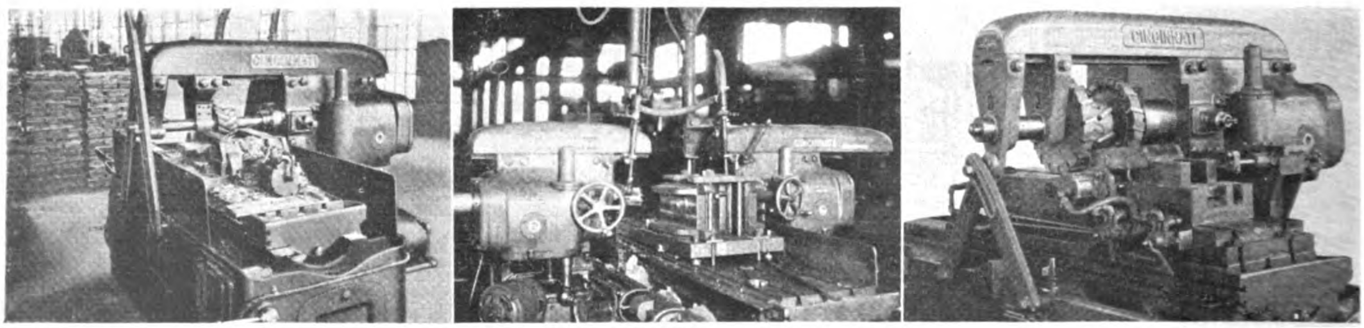
The duplex Hydromatic is equipped with individual torque motors mounted on the elevating brackets for moving the heads vertically by power. The control is by means of drum-type switches on the side of the bed. The head of the machine (or spindle carrier) is fitted with taper gibs with means for very sensitive adjustment so that the head may be clamped to the headstock by means of a cam lever below the overarm. A similar lever is used to clamp the quill, which also has a large handwheel for rapid and accurate hand adjustment. These are refinements in control designs to conserve the energy of the operator.

The 12-In. Fay Automatic Lathe

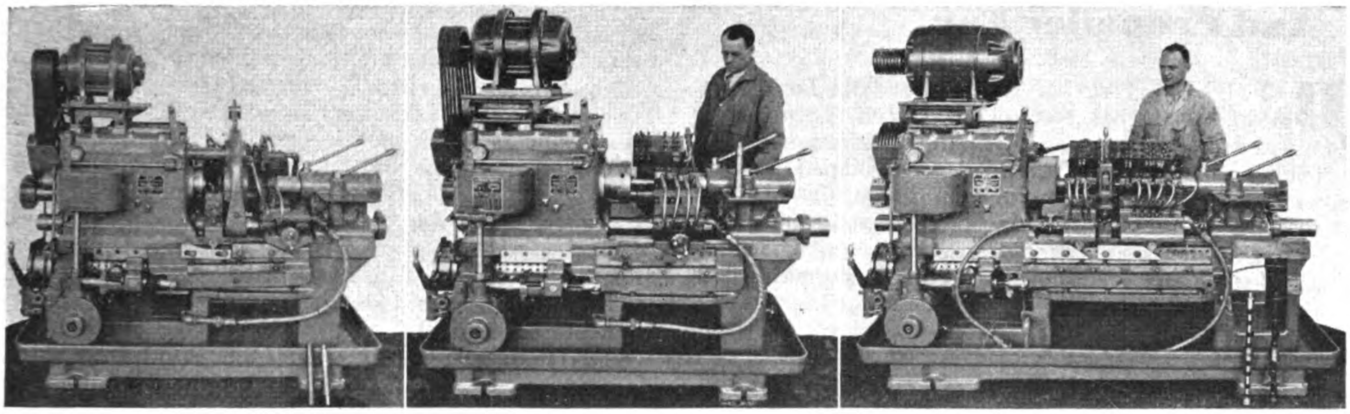
THE 12-in. Fay automatic lathe, manufactured by the Jones & Lamson Machine Company, Springfield, Vt., is a high-production machine that can be operated economically on continuous production or used for small lot manufacturing where several sizes and types of parts are required to make up a machine load. It can be set up in a short time for different work and, with its universal camming, standard tool blocks, wide range of speeds and feeds, and multiple tooling possibilities, makes a machine that will cover varied types of work supported between centers or held in a chuck or fixture. All tool movements are controlled by cams on the outside of the drum and the necessary movements have been incorporated in this machine to permit multiple tooling of any piece so that it may be machined using the shortest possible tool travel. It is built in four different lengths of bed: 15 in., 21 in., 33 in., and 45 in. between centers. It swings 13¼ in. over the center bar and 19½ in. over the carriage.

The bed is of box ribbed construction and is designed to give maximum strength and stiffness required for heavy work. The pan is cast integral with the bed and is provided with a large chip storage which is easily accessible for cleaning.

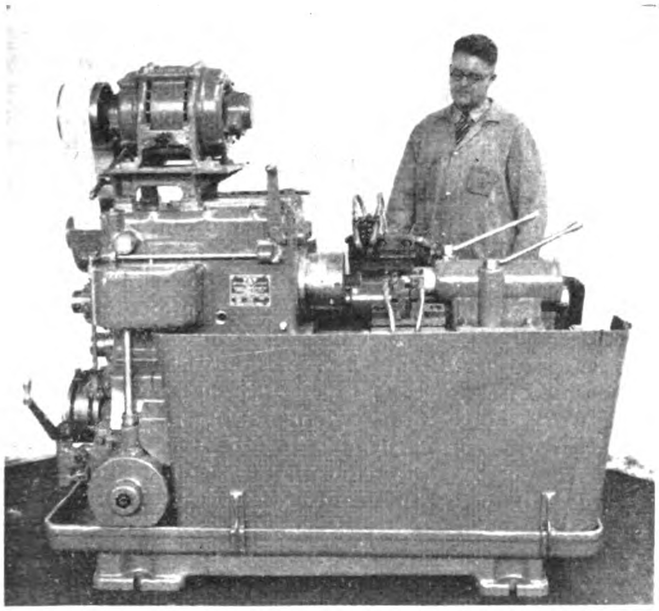
The headstock is a single pulley drive and equipped with anti-friction bearings throughout. The drive is through a multiple-disc clutch in the main drive pulley. The spindle, made from an alloy steel forging accurately machined and ground, is mounted on ball bearings set up under a predetermined pressure. All gears and shafts are hardened. The shafts are ground and mounted on ball bearings. The complete headstock runs in a bath of oil and both the fast motion and feed-gear mechanisms are lubricated by a splash system from the headstock. It has eight standard spindle speeds through four sets of change gears. With the main



Left: Cincinnati Hydromatic miller set up for milling switch plates held in a pneumatic fixture—Center: A Duplex Hydromatic set up to mill a driving box; the fixture is arranged to tilt to mill the "rock" on the box flanges—Right: Milling shoes and wedges



Left: The center drive attachment used on the 12-in. Fay automatic lathe—Center and right: Multiple tooling attachments



The 12-in. Fay automatic lathe

driving pulley running at 1,000 r.p.m., the following speeds can be obtained: 56, 72, 98, 130, 162, 215 290 and 377 r.p.m. A standard automatic speed-shift shaft can be installed so that two changes can be made automatically while the machine is under cut. Spindle speeds up to 1,500 r.p.m. can be obtained through semi-standard gearing.

The front carriage, or turning member, is supported at the center of the lathe by a heavy steel center bar supported in four renewable bearings in the headstock and tailstock. The outer end of the carriage is carried on a hardened and ground former which is mounted on a slide gibbed to the front of the bed. Both the center bar and the former slide are moved longitudinally by cams on the drum. By setting the hardened former parallel to the centers or on an angle, straight or taper work may be produced. This applies both for turning or boring. It is also possible to bore or turn any uneven profile or radius by installing a special hardened and ground former on the machine. The turning tools can also be arranged to relieve on the return stroke to avoid scoring the finished work.

The back arm or facing member is mounted on a large steel bar and is held in three adjustable bearings in the headstock or tailstock. The lower end of the back arm operates against the side cam or former on the rear former slide. The rear former slide may be drawn under the back arm by suitable camming. The back arm may also be moved longitudinally and, therefore, turn any straight, tapered or curved surface. The longitudinal movement may be combined with the facing travel so that a combination of turning and facing cuts may be taken if the piece being machined requires it. For facing bevel gears or similar parts an adjustable bevel attachment can be furnished. This bevel attachment has hardened guides which control the cut with this bevel attachment. Curved surfaces may be machined or any irregular shape by supplying special curved or irregular shaped guides.

The cam drum, with its adjustable outside cams, controls all movements. It has a fast motion through a multiple-disc clutch at the rear for idle movements and a slow motion or feed through change gears and a feed shaft at the front of the machine. The change in drum speeds from fast to slow motion and vice versa is controlled by adjustable cams and is entirely automatic. An adjustable knock-off disengages the main drive clutch and stops the machine at the end of one complete cycle of the machine. The main drum is located in a box-like recess in the bed directly beneath the headstock. The 12-inch by 21-inch, 12-inch by 33-inch, and 12-inch by 45-inch machines have two cam drums, one under the headstock and the other under tailstock. Should the occasion ever arise that more cam room be needed an auxiliary drum may be attached to either end of the machine.

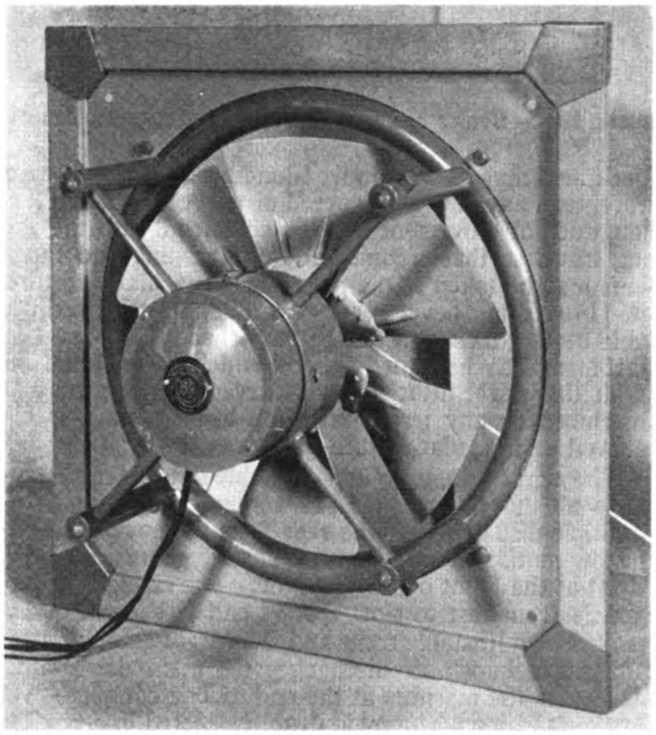
The machine has nine feeds through five sets of change gears. The drive is through change gears and a feed shaft. The carriage or turning feeds are .008, .011, .014, .019, .023, .027, .038, .048, and .062 inch per spindle revolution The back arm, or facing feeds, are .008, .010, .019, .012, .017, .021, .024, .034, .043, and .056 inch per spindle revolution.

Dovetail tool blocks and slides are furnished with this machine to provide for a wide range of work. The dovetail tool blocks are made from heat-treated alloy steel and are reversible so that they may be placed on a dovetail slide with the tool slot toward the headstock or toward the tailstock as desired. All dovetail slides and tool blocks fit both carriage and back arm. One wrench fits all screws. A standard taper turner works in conjunction with these standard tool blocks so that straight and taper cuts may be taken simultaneously. Any curved or tapered surface may be machined with this turner which will reproduce and form developed in the operating template.

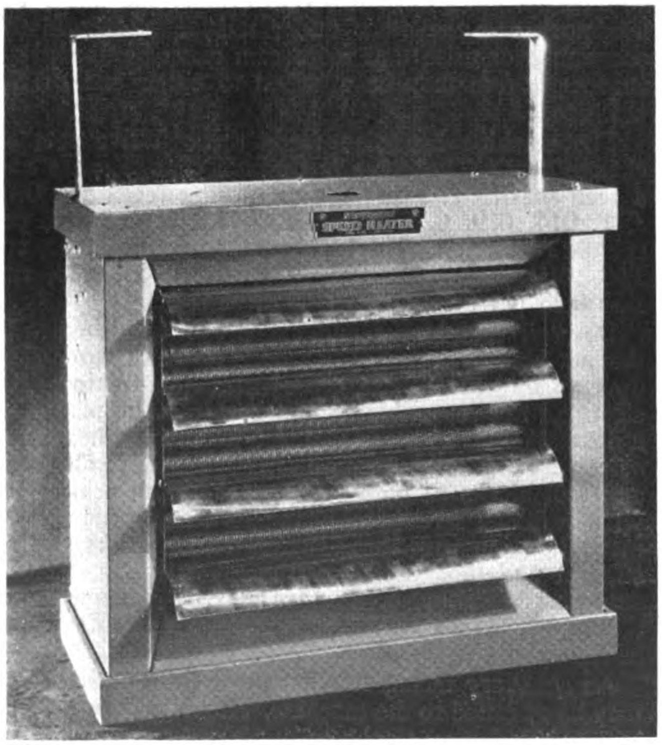
An auxiliary facing attachment or third cutting head may be attached to the machine. This is supported on a bar mounted through the tailstock and held in an outboard bearing in the headstock.

Sturtevant Speed Heater And Propeller Fan

B. F. STURTEVANT Company, Hyde Park, Boston, Mass., has recently developed the propeller fan and speed heater shown in the illustrations. The propeller fan consists of the blade, a U-shaped pressed-steel ring and a suitable motor mounting. The blade of the propeller fan has a varying pitch to make it equally effective at the base and at the tip while the U-section pressed-steel ring is designed to promote a smooth flow of air through the fan and to contribute to its efficiency. The mounting designed for the fan dampens vibration and offers minimum resistance to air flow. It is formed of steel tubing and bars welded to the U-section ring to make what virtually is a one-piece construction. The motors used in conjunction with the fan are of the ball-bearing type designed to operate 5,000 hrs. without lubrication attention and are suitable for either horizontal or vertical operation. They are totally enclosed to guard against dust and moisture and are equipped with speed regulators if desired. The panel mounting illustrated with the fan is furnished as an accessory. It is of welded pressed steel construction and can be securely fastened to the fan.



The Sturtevant propeller fan



The Sturtevant speed heater

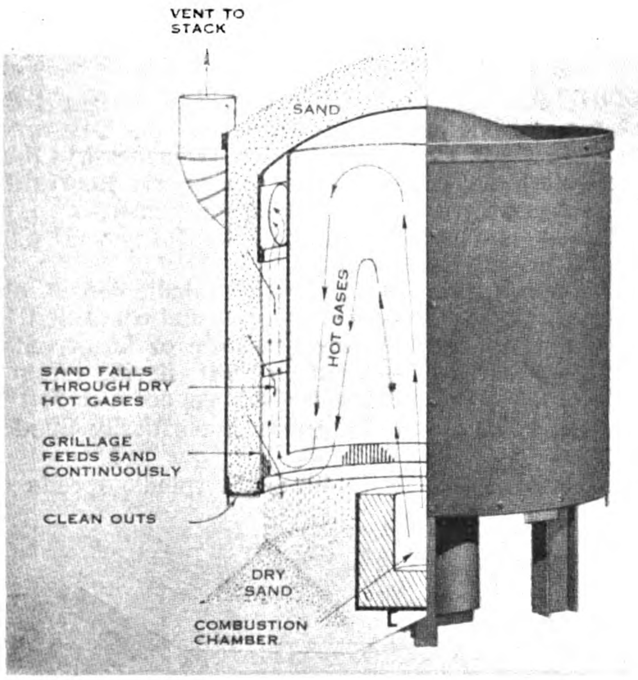
The fan is made in 12-in., 16-in., 20-in. and 25-in. sizes and can be furnished with automatic shutters or safety guards, or it can be used in connection with a pent house when it is desired to install the fan on a roof. The automatic shutters consist of light aluminum leaves, linked together, mounted on hinge rods and supported in angle-iron frames. When the fan is running, the movement of the air holds the leaves open; when the fan is not in operation the weight of the leaves keeps them closed, blocking the opening and shutting out rain and snow. The safety guard which can be used in conjunction with the fan consists of ½-in. mesh wire screening, welded to wire rings and cross braces. When in position it completely covers the fan wheel. The pent house used with the fan is made of sheet steel riveted to an angle-iron framework. The shutter leaves are similar to those used on the automatic shutters and automatically close when the fan is not in use.

The speed heater shown in another of the illustrations is designed for use in shops, enginehouses and small outlying work shops. It has two operating speeds. The high speed is used primarily for fast heating and the low speed for maintaining a normal set temperature. It is designed for use with steam pressures up to 250 lb. but the heating elements are designed to work as efficiently with low- as with high-pressure steam. No alterations or special provisions are necessary to operate the heater on different steam pressures.

The heaters are equipped with louvres, their purpose being to break up the air flow and spread it over a wide area. The heater may be equipped with thermostatic control of various types, one type shutting off the steam, while another shuts off the fan, leaving the steam in the heater. The use of the various thermostatic-control devices depends on conditions surrounding the installation of the heater and can be furnished to specifications for particular installations. The heaters are made in six sizes weighing 65 lb., 70 lb., 125 lb., 150 lb., 180 lb. and 410 lb. respectively, and are equipped with standard-voltage motors.

Reverse-Draft Sand Stove

THE Johnson Manufacturing Company, Minneapolis, Minn., has recently placed on the market the reverse-draft sand-drying stove shown in the illustration. The stove is equipped with a vacuum-type oil burner, the hot gases from which are reversed twice before escaping through a vent to the stack. The continued application of the hot gases provides uniformly dry sand free from ash and coal dust. The dry sand falls through the dry hot gases, the grillage, which forms one wall of the vent for hot gases, feeding sand continuously as it becomes dry. The direction of the gases and the manner in which the sand feeds through the grilled walls of the



The Johnson reverse-draft stove for drying sand

sand chamber is shown graphically in the illustration.

The stove is 5 ft. high, 4 ft. 2 in. in diameter and has a hopper capacity of .85 cu. yd. (2,750 lb.). It has a sand capacity of .5 cu. yd. per hr. (1,620 lb. per hr.) and a fuel consumption of 1.6 gal. per hr, which is the equivalent of 1 gal. per 1,000 lb. of sand or 1 gal. per 3.2 cu. yd.

Rooksby Portable Cylinder Boring Bar

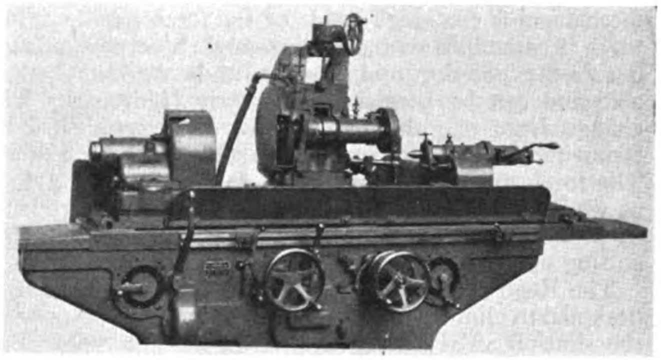
E. J. ROOKSBY & CO., 1042 Ridge avenue, Philadelphia, Pa., has incorporated several improvements in its unit quick-centering valve-chamber boring bar which are of particular advantage for valve-chamber boring where a high degree of accuracy and a high quality of workmanship are essential. This machine is also equipped with Rooksby unit quick-centering crossheads for use when the railroad has a number of locomotives having the same size bushings to be rebored. This feature saves time in setting up the bar, as the crossheads fit in the end of the valve chamber and are self-centering.

A description of the motor-driven Rooksby portable cylinder and valve-chamber boring bar appeared in the June, 1925, issue of the *Railway Mechanical Engineer*, page 386. Previous to the improvements referred to in preceding paragraphs, the gear drive for all Rooksby boring bars was made in sizes below six inches with spur gears. The new gear drive has helical gears which reduce maintenance and also insure accurate work free from chatter marks. The drive is entirely enclosed with guards, cast integrally with the frame, which tend to strengthen the body of the machine.

The unit quick-centering crossheads are extra heavy with the arms designed wide at the center and tapering to the ends. The tool holder can be used with high-speed steel or Stellite cutters, thus eliminating forged tools. The valve-bar cutter heads have a tool holder built in, thus enabling the shop to use the same size gears as are used in the tool holders of the cylinder bars.

Cincinnati Universal Cylindrical Grinder

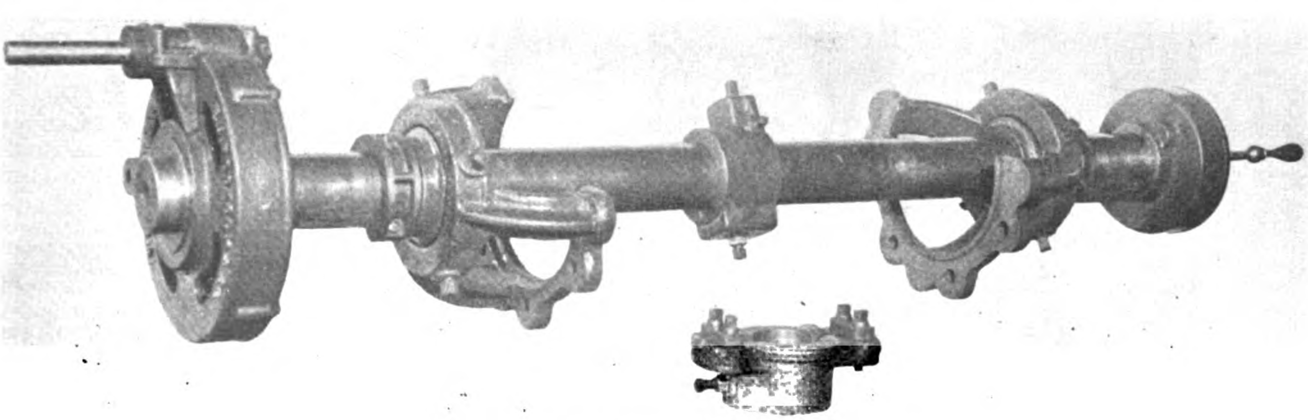
A SPECIAL adaptation of the Universal cylindrical grinder was recently supplied to a large railroad by Cincinnati Grinders, Inc., Cincinnati, Ohio, which permitted the machine to be used both for straight cylindrical grinding and for cutter grinding. The machine, a Cincinnati 16-in. by 48-in. Universal grinder,



The Cincinnati 16-in. by 48-in. cylindrical grinder

was standard throughout with the exception of the grinding-wheel head. The standard head was replaced by a head carrying a vertical slide adjustment and spindle with a wheel at each end.

As shown in the illustration, a straight-sided wheel for cylindrical work is mounted on the left end of the spindle, and a cupped wheel for cutter grinding is



Rooksby unit quick-centering valve boring bar

mounted on the opposite end. This head is carried on a swivel base which makes it easy to move the wheel quickly into position. For a wide range of universal work in railroad shops the straight-sided wheel is used and for heavy cutter grinding the base is swivelled and the cupped wheel employed. A small hand wheel located on the top of the fixture operates the vertical spindle adjustment. A screw moves the slide which rides on a scraped dovetail and is secured by a tapered gib. By adapting this standard machine to large cutter and reamer grinding the usefulness of the machine in the railroad shop is increased.

Bastian-Blessing Cutting And Welding Equipment

THE CC cutting torch, shown in the illustration, is a product manufactured by the Bastian-Blessing Company, 240 East Ontario street, Chicago. The object of the design is to provide a light-weight, heavy-duty tool made from strong materials to permit a reduction in the size and weight of the various parts without sacrifice of strength or capacity. All parts are made of bronze forgings, bar stock or tubing, with the exception of the head, which is of drop-forged monel metal.

Both preheat control valves and the high-pressure oxygen control valve are located in the base valve and are accessible for servicing from the outside. No mechanism is contained inside of the torch handle. The torch is assembled with a 90-deg. angle head as standard, but 75-deg., 35-deg. and straight heads are interchangeable and can be furnished separately if desired. The change from one angle to another is accomplished by removing the two lock nuts at the end of the head tubes. The torch may be had with tips for use with acetylene as well as other types of fuel, such as butane, propane, by-products, coke gas and natural gas, with capacity for cutting up to 18 in.

The Rego economizer is a gas shut-off device that is designed to eliminate leakage. It has no packing or seat, the shut-off valves being of the diaphragm type. The diaphragm of the valve acts as the seat, this construction being adopted because of the little likelihood of leakage. The Rego economizer is obtainable for both high- and low-pressure gas systems.

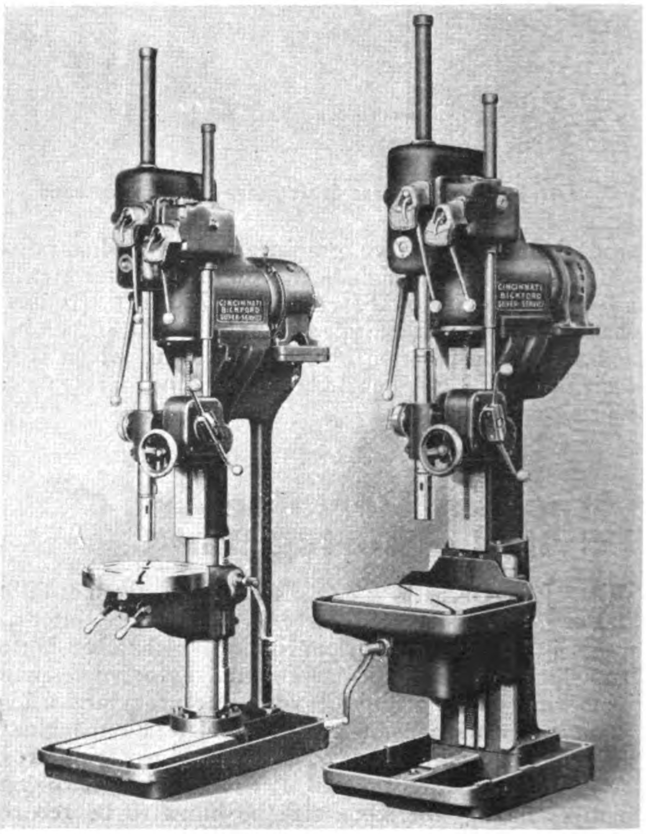
The Red Star regulator is designed to supply a constant delivery pressure at any desired point from one to thirty pounds. It delivers gas to welding and cutting torches simultaneously and is designed to assure a constant neutral flame regardless of the pressure of the tank.

Super-Service Upright Drilling Machines

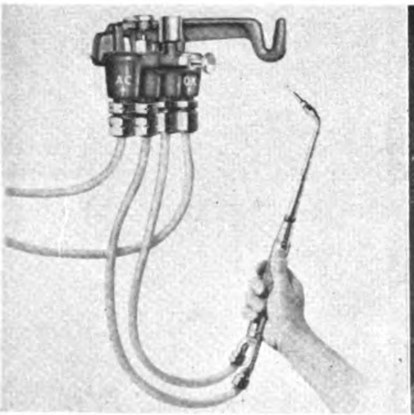
THE development of a 21-in. and 24-in. upright drilling machine has been completed by the Cincinnati Bickford Tool Company, Oakley, Cincinnati, Ohio. These machines, to be known as Super-Service uprights, are built in either round- or box-column construction, as illustrated, and may be equipped either for general purpose or single purpose work.

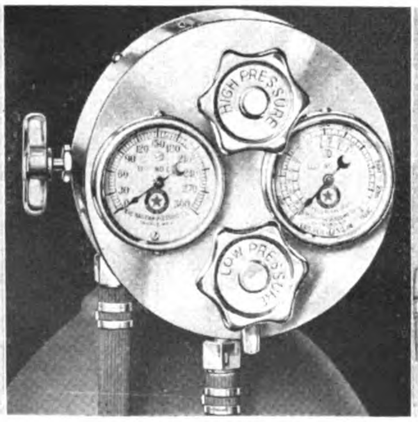
The standard machine has twelve spindle speeds, obtained through selective sliding gears and controlled by a single lever. The sliding gears are of heat-treated chrome-nickel steel mounted on shafts having integral multiple keys. Ball and roller-bearings are included in the design and all mechanism is automatically flooded with oil.

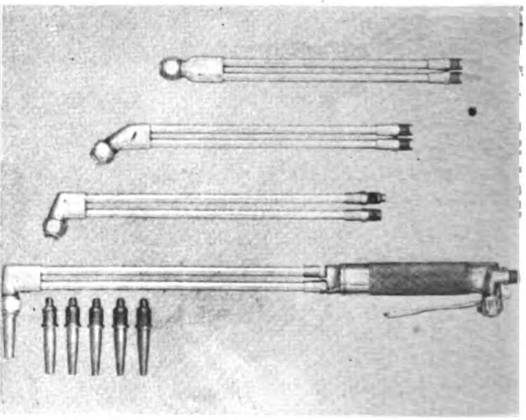
Direct-reading plates indicate the spindle speeds at



The Cincinnati Bickford Super-Service upright drilling machines of round- and box-column construction







Left: The Bastian-Blessing Rego economizer—Center: The Red Star regulator—Right: The CC cutting torch

which the machine operates and also indicate nine rates of feed which are controlled by a single lever. The feed changes are obtained through selective heat-treated alloy steel sliding gears with broached integral keys. The sliding head is counterbalanced and is fully enclosed. The feed is engaged by either of two pilot levers which control the advance and return of the spindle. A sidewise movement of either of these levers engages a positive-type feed clutch which controls a constant-mesh worm-type feed engagement running in oil. An adjustable feed trip may be set to disengage the feed at the required depth, while safety trips automatically disengage the feed at the top and bottom limits of travel.

The 3-hp. or 5-hp. motor with which the machine can be equipped is directly connected and its closely coupled mounting locates it out of the operator's way and in a position where chips and dirt cannot cause damage. The driving clutches are built along the Cincinnati Bickford unit principle of design by being completely assembled in a self-contained drum housing. They are mounted on large ball bearings and are automatically flooded with oil. The forward and reversing clutches are actuated through internal expanding rings of heat-treated bronze, fitted into hardened steel cups which are integral with the driving bevel gears. The driving clutches operate at constant speed to insure constant maximum power at all spindle speeds.

On the round-column machine the table arm, as well as the table, is clamped from the front. The Super-Service uprights are to be had as single units, or combined into drills of either the high base or low base type.

Covel-Hanchett GK Grinder

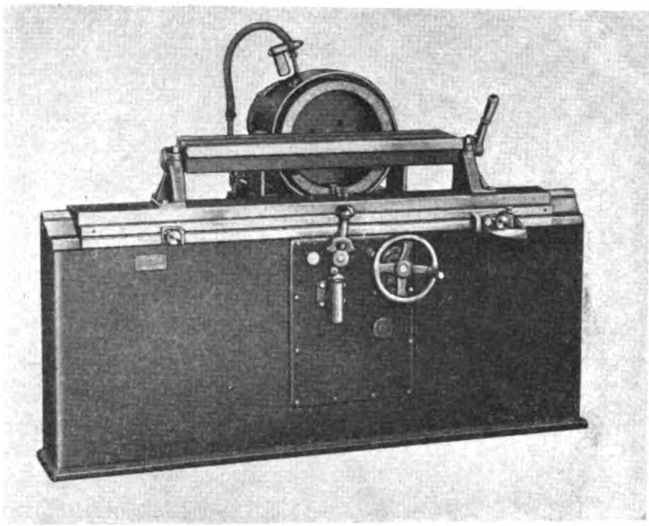
IN the illustration is shown the Covel-Hanchett GK grinder, a product of the Covel-Hanchett Company, Big Rapids, Mich. The grinder is equipped with a cabinet base, ball-bearing arbor, a Hanchett Red Anchor cylinder grinding wheel and water attachments, and is designed for full automatic operation. These machines, in the smaller sizes, cover a range of service largely employed in car shops, pattern shops, planing mills, etc. In the larger sizes they are for grinding veneer and paper knives, shear blades, and other comparatively long unit grinding service.

Standard equipment includes a 12-in., 14-in., or 16-in. grinding wheel (according to the capacity of the machine) of the Hanchett Red Anchor cylinder-wheel type which is designed to save approximately 40 per cent in grinding-wheel expense over the ordinary cup grinding wheel. A segmental wheel in an all-steel chuck can be supplied when desired in place of the Red Anchor cylinder wheel.

The knife bar is installed as a solid unit integral with the carriage, with no slide adjustments or adjustable connections. Instead of feeding the knife bar, slides, supports and work to the grinding wheel, the grinding wheel is fed to the work. The grinding head is mounted on a broad, heavy slide, making a rigid mounting and facilitating the control of the feeding and grinding operations.

The grinding-wheel spindle is equipped with New Departure ball bearings. All other bearings with running shafts are of bronze. The transmission of the clutch gear type is installed and is removable as one complete built-in unit, enabling ready access for replacements or repairs. Cross-feed of the grinding wheel can be operated both by hand and automatically.

The grinder is furnished with a knife bar having heavy cored sections with T-slots, or a combination bar with T-slots and separate clamps for thick and thin knives. An indicator, furnished for grinding at any bevel, is adjustable for grinding towards or away from the knife edge.



The Covel-Hanchett GK Grinder the grinding wheel of which is fed to and away from the work

A large tank in the base of the machine with a built-in centrifugal pump supplies water or cooling compound at the grinding wheel. The machine is compact, with all units built into the machine base to combine low cost and minimum space.

All-Welded Rolled-Steel Gear Blank

LUKENWELD, Inc. (division of Lukens Steel Company), Coatesville, Pa., which is primarily engaged in the design and manufacture of welded steel assemblies for machinery and equipment, has developed and is now manufacturing all-welded rolled-steel gear blanks for use in the manufacture of cut gears. This gear blank is the culmination of a considerable period of research and experimental work, and patents on the blank have been applied for.

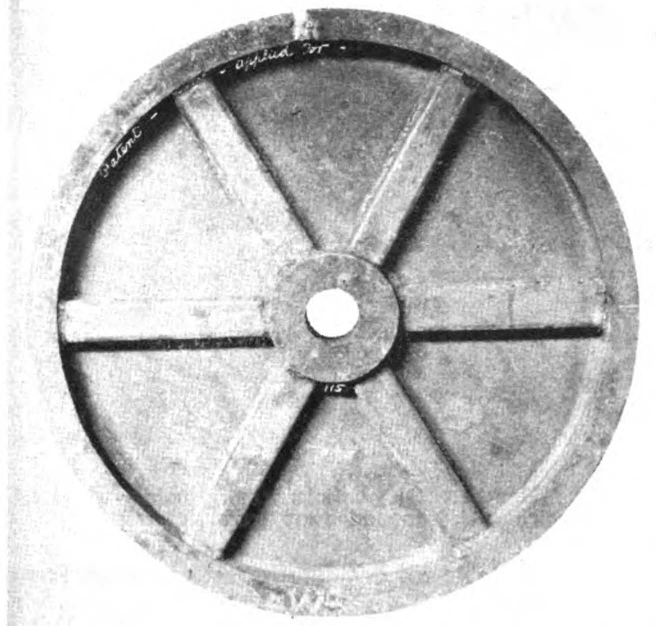
The welded steel blank, which can be employed in the manufacture of spur, herringbone and helical gears, can be made any size from 24 in. outside diameter up. The largest all-welded gear blank made up to the present time is one with a shipping weight of 4,350 lb. It is of 66¾-in. outside diameter, 11¾-in. face width, 4⅛-in. thickness, and 22½ in. hub diameter.

While the all-welded gear blanks are ordinarily made entirely from S. A. E. 1020 carbon steel, the rims can be furnished in steels of special analyses if desired.

The hubs of the all-welded gear blanks are first cut by gas from solid rolled steel of the thickness to give the desired hub diameters. The webs are gas cut from rolled-steel plate, as are the ribs, the latter being formed into channels of the required section. The webs are arc welded to the hubs, and the reinforcing channels are welded to the web structures. The final operation consists of the circular bending of the gear ring and arc welding it in position to form the finished gear blank.

Before shipment all of the welded gear blanks are carefully and thoroughly annealed under pyrometric furnace control. Welding operations are under rigid procedure control and in accordance with insurance welding practice.

Since no time is required for pattern making, this construction has an important advantage in filling re-



The Lukenweld all-welded rolled-steel gear blank

quirements occasioned by gear breakdowns. The major advantages of the all-welded gear blank, however, are the purity and homogeneity of the thoroughly annealed rolled steel from which the gear blanks are made. Rolled steel is free from blowholes, gas pockets, hard or spongy spots and other defects, and gear rings made of it can be uniformly cut, with teeth that will be sound in structure.

Horizontal Boring Drilling And Milling Machines

TWO spindles,—the conventional main spindle and an auxiliary high-speed spindle—comprise one of the features of the No. 70 horizontal boring, drilling and milling machine recently developed by the Giddings & Lewis Machine Tool Company, Fond du Lac, Wis. The main spindle, 7 in. in diameter, gives 36 speeds in geometrical progression within the customary range for a machine of its size. The auxiliary high-speed spindle, 4 in. in diameter and mounted within the back-gear shaft of the main spindle, gives an additional 36 speeds or a range of four times that of the main spindle. These two spindles give a combined speed range of from 3 to 720 r.p.m.

All the speeds and feeds for the spindles are built within an enclosed head. The 36 changes of speed of either spindle are controlled through two levers, each speed-change lever having a position indicator that facilitates the selection of the desired speed.

The 18 feeds of either spindle are obtainable through a feed unit built on one of the front cover plates of the head. The removal of this plate removes the complete feed unit for inspection. A rotary gear-change lever controls nine feed changes and indicates on a dial the feed applying at any time. A back-gear lever connects the rotary gear-change lever with another nine feeds. A set of pick-off gears is incorporated in the feed-gear train so that by different gears any desired lead may be obtained. A hand wheel is provided at the upper left of the head for a slow hand feed to either spindle. The feed is applied to the spindles by rack and pinion. The racks have a loose tooth at each end as a safety limit to the travel of the spindles in either direction.

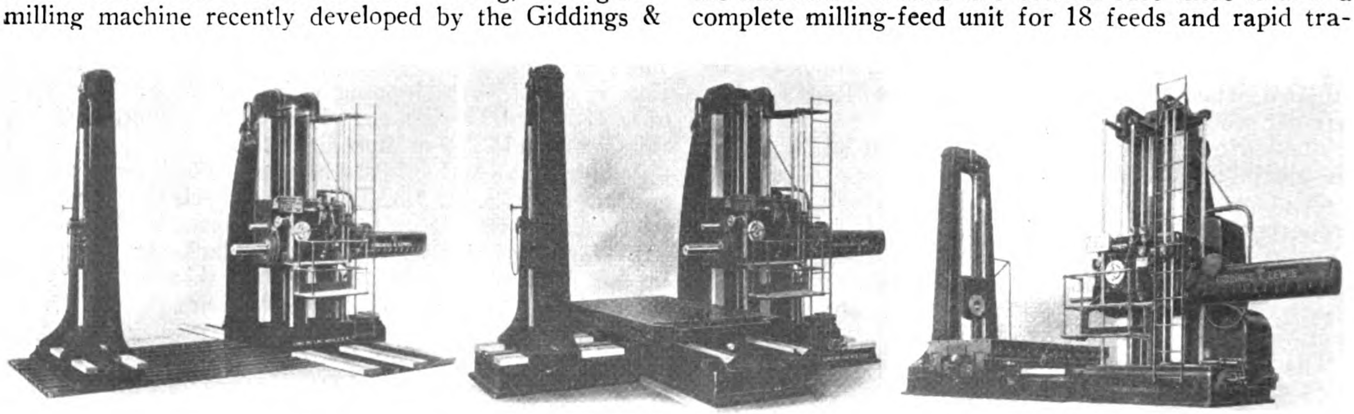
Incorporated in the feed train is an automatic depth gage which is applicable to either spindle. It can be set to automatically throw out the feed at any point within a 3-in. travel on the main spindle and within a 6-in. travel on the high-speed auxiliary spindle.

A spindle selector lever controls the operation of the spindles. When the speed and feed mechanism is connected to the high-speed spindle the spindle selector lever keeps the main spindle from coasting. A separate clamp is provided for locking either spindle in any position for milling.

The entire head is automatically lubricated. A pump delivers oil to a distributor at the top of the head from which oil is directed over the inside of the head, lubricating all running parts. A platform is attached to the head and travel with it for the convenience of the operator.

The column for the head weighs approximately 18,000 lb. On the inside it is ribbed in both directions to offer a stiff support for heavy milling at the extreme travel of the head. A counterweight for counterbalancing the head is within the column.

The column sets on a large base which contains the main driving clutches for starting, stopping and reversing the machine. Within this column base there is also a complete milling-feed unit for 18 feeds and rapid tra-



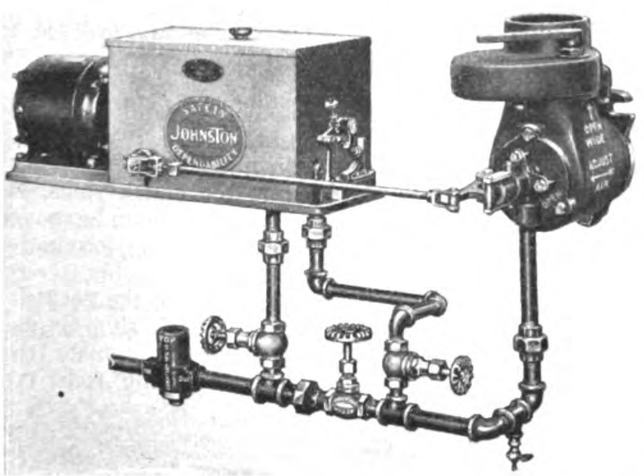
Left: The Giddings & Lewis floor-type horizontal boring, drilling and milling machine—Center: The planer-type machine —Right: The table-type machine

verse for moving all the different units of the machine. In this way it is possible to obtain a range of feeds in inches per minute that are suited to milling, and independent of the boring and drilling feeds for the spindles. The changing of feeds is accomplished through a back gear lever and a rotary gear change lever mounted on the head of the machine close to the spindle feed-change levers.

The illustrations show the table type, planer type and floor type machines in which the No. 70 machine is obtainable. For all three types the same head, column, column base, mechanism and end support are used. On the table-type and planer-type machines a box table is used with a large number of reamed stop holes in the top and tee slots that run the full length of the table. On the table- and planer-types the end support block moves in unison with the head. On the planer-type the head, column and column-base mechanism are movable along a runway at right angles to the travel of the table. The table type machine can be equipped with tables up to 72 in. by 144 in.

Automatic Controllers For Oil Burners

AN automatic controller for oil burners designed with a piston oil feed has recently been placed on the market by the Johnston Manufacturing Company, Minneapolis, Minn.



The Johnson automatic controller for oil-burner equipment

The controller is designed to be unaffected by sediment or other solid or semi-solid matter or water in the oil. In order to deliver the proper quantity of oil continuously regardless of the quality of the oil, and to eliminate clogging by dirt in the line, the controller is constructed with no valve adjustment in the oil line.

The controller consists of a power-driven oil metering pump driven by a directly connected constant-speed motor, in connection with an adjustable crank for connection to the air-controlling mechanism of the burner. The controller operates in connection with any standard control pyrometer or control thermometer. It operates on the high-low principle and is not intended to operate on-off burners.

In operation, the driving motor and metering pump run continuously, no other parts operating except when cycling. The oil is metered to the burner and adjusted by levers and screws located at one end of the unit. All the oil delivered to the burner passes through the metering pump and is metered to the burner regardless of its temperature, viscosity or pressure as long as these remain constant within the usual limits. The controller is fitted with a Johnston V-notch oil valve in a by-pass to the burner to provide a means for manual operation for special purposes when manual operation is more convenient than automatic. The air connection may be disconnected at the burner and the air adjusted by hand at the same time.

The controller is made in two sizes, B-7 and B-9, which have capacities of 20 gal. and 30 gal. per hr. respectively. The net weight of the controller is 78 lb.

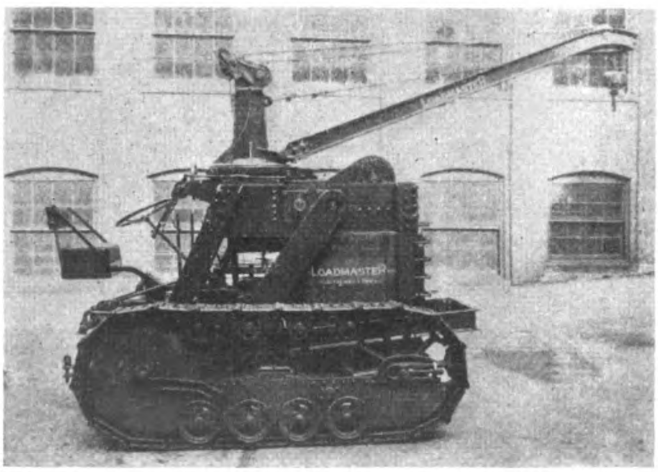
Crawler-Mounted Loadmaster Crane

IN the illustration is shown a Loadmaster crane equipped with a Model GH Trackson crawler. This crane, made by Bucyrus-Erie Company, South Milwaukee, Wis., provides a means for lifting, carrying and spotting heavy or unwieldy objects such as car parts, rails, freight, etc., in railway shops, yards and warehouses.

The mobility of the Loadmaster equipped with Trackson crawlers permits its use wherever the crane is needed, inside the shops or in the yards. It is equipped with ground-gripping crawlers to provide sure footing and positive traction in soft, loose sand, slippery mud or clay, cinders, sawdust, wet snow, etc. The unit is compact and can be operated in very close quarters since it has a fully revolving boom and is designed to turn in a short radius. It is 9½ ft. in overall height to permit it to travel through doorways.

A feature of the crane is the fully revolving boom which permits the operator to spot and pick up the load quickly and to place it accurately. The boom is power driven and is equipped with a brake so that it may be set at any angle desired over the front or sides of the tractor. The speed of the boom's swing is controlled by the operator.

With the standard 14-ft. boom the Loadmaster has a maximum lifting height of 16 ft. 6 in. under the hook. With the boom lowered, it has a maximum outreach of 14 ft. from the center of the mast in any direction. Where unusual conditions require a higher lift



The Bucyrus-Erie Loadmaster fully revolving crane equipped with a model GH Trackson crawler and McCormick-Deering power unit

or greater outreach, special booms can be furnished.

The crane may be used for hauling purposes as well as for lifting. The Trackson crawler used on the Loadmaster crane is manufactured by the Trackson Company, 1320 South First street, Milwaukee, Wis. The Loadmaster is also available with wheel mounting.

Niles No. 6 End-Drive Lathe

THE Niles No. 6 end-drive lathe recently placed on the market by the Niles Tool Works Company, Hamilton, Ohio, is a high-production machine suitable for turning axles, forgings, piston rods, crank pins, brake-beam ends, etc., and is designed to permit precision work as well as rough turning. The headstock, mounted on the bed at the left-hand end of the machine, is fully enclosed. The main gear and pinion, of steel and of the herringbone type, are lubricated by running in an oil bath. End thrust is taken up by a series of bronze liners, one rotating in an oil-filled trough below it, providing continuous lubrication. A face plate of any design to meet specifications can be furnished.

The feed box is a fully enclosed unit mounted on the front face of the bed adjacent to the headstock. The feeds are driven through sliding steel gears and are changed by long vertical feed-change levers located in front of the feed box for ease of operation. The feed shaft is provided with a ball end-thrust washer lubricated by a centralized oiling system which furnishes lubrication for all gear faces and bearings.

The carriages, which can be arranged to suit requirements, have longitudinal feed through half nuts engaging the lead screw, while hand longitudinal traverse and hand cross feed to the tool is also provided. The lead-screws half nuts are disengaged through a spring-actuated hand knockout. The carriages have a large bearing area on the bed and are fitted with taper gibs at both the front and rear bed way, and a clamping bolt for locking them in a fixed position. Wipers with felt pads are attached to wing ends for removing all chips and dirt from bed ways and to provide a continuous supply of lubricant. The aprons are of double-walled construction, enclosing all operating mechanism and eliminating overhung shafts.

The tailstock, which can be arranged with either a live or dead center, is made up of two sections, the top one having a slight cross adjustment for taper turning. It is traversed by rack and pinion by means of a hand lever. The spindle is moved in and out by means of a hand wheel and is locked in position by a clamp which does not affect its alinement. A coolant system is provided, circulated through a motor-driven rotary pump unit which is attached to the rear of the machine. The bed of the machine is a rugged casting. All the gears of the machine have the Maag tooth form and are lubricated by the centralized oiling system which furnishes lubricant, where possible, to all moving parts.

Piston-Rod and Valve-Stem Packing Boring Machine

THE Whiting Corporation, Harvey, Ill., has recently brought out a pneumatically operated boring machine for machining piston-rod and valve-stem packing. The cutting tool revolves at 300 r.p.m. and feeds downward .006 in. per revolution and, when through the bore, the feed cuts off automatically. To elevate the spindle to starting position a knob at the side of the machine is raised which permits the spindle to come up automatically at the controlled rate of ¼ in. per revolution.

A ball-bearing, rotary air motor is built into the base of the machine. The boring spindle and its bearings are hardened and ground. Chuck rings or adapters for holding the packing while boring are ordered to specifications submitted by the purchaser to fit various sizes of packing.

The machine can be installed in several ways. It can be bolted to a bench, to a bracket on a wall or on a post, or it may be placed on a pedestal base which also includes shelves for holding the chuck rings. It may also be mounted on a truck so that it can be moved to any convenient location adjacent to the locomotive for which the packing is being bored.

The machine was designed to eliminate the necessity of the mechanic making trips to the back shop or machine shop for the bored packing and to eliminate trips to and from the locomotive for calipering rods, etc.

The Niles No. 6 end-drive lathe for turning axles, forgings, piston rods, crank pins, etc.

It is adapted to enginehouse use for completing packing accurately and quickly.

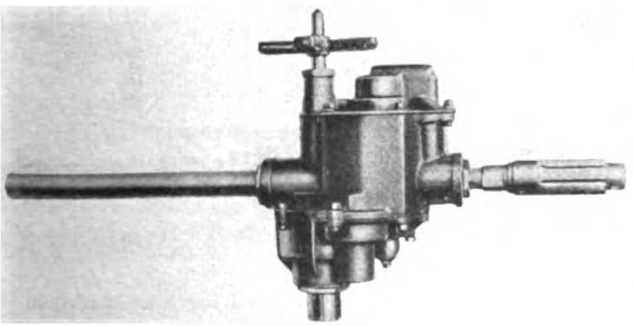
Tests conducted with the machine have shown that packing can be bored completely in two minutes. The machine weighs 100 lb. but with a pedestal attached the total weight is 175 lb. The machine is particularly useful in a large enginehouse where all

The Whiting locomotive piston-rod and valve-stem packing boring machine

the time of one man is devoted to renewing piston-rod, valve-stem, boiler-feed pump and air-pump packing. The machine can also be used at small outlying points for boring packing where a lathe is not a part of the enginehouse equipment.

Chicago Pneumatic No. 99-C Rotary Drill

THE No. 99-C pneumatic rotary drill recently developed by the Chicago Pneumatic Tool Company, 6 East Forty-fourth street, New York City, is designed



The CP No. 99-C pneumatic rotary drill

for general-purpose drilling and reaming, especially in close quarters. It is a power-vane tool employing no pistons, toggles or crank shaft and is equipped with a replaceable hardened-steel cylinder liner, ball or roller bearings throughout, as desired, and is of through-bolt construction to facilitate repairs. It is furnished with a governor control on the intake air supply to maintain free speed and to reduce air consumption on the power side and back pressure on the exhaust side. Governor-controlled light speed prevents wear and breakage of taps, drills and reamer bits. The drill is equipped with an adjustable exhaust deflector and muffler and is of the offset motor design with inside M.T. socket, feed screw and extractor pin, with a grease seal to prevent grease from entering the spindle socket. Complete lubrication for the motor is effected by a line oiler located in the housing. The drill is also furnished with adjustable fittings on the gear and governor cases.

The drill is regularly furnished with a standard type throttle but a throttle of the safety type can be furnished if specified. The drill weighs 35 lb., and operates at a light speed of 300 r.p.m. The length of feed is 4½ in. and it has drilling capacity of 1½ in. and a reaming capacity of 1⅛ in.

American 30-in. Super-Productive Lathe

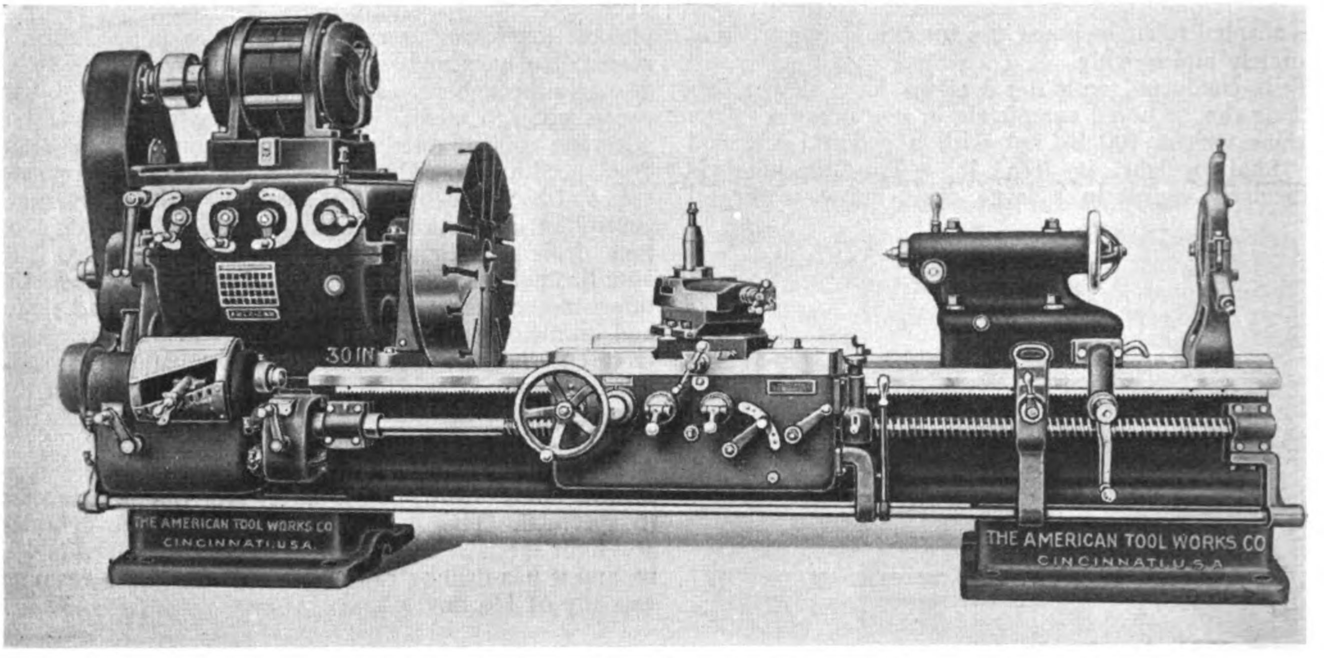
IN the illustration is shown a 30-in. American lathe which is equipped with a 16-speed triple-geared head with face-plate drive. The lathe, a recent product of the American Tool Works Company, Cincinnati, Ohio, is of the geared selective-speed type and can be either belt or motor driven. The design provides 8 of the 16 spindle speeds through internal-gear face-plate drive. The remaining eight spindle speeds are transmitted through the spindle gear. The highest internal gear speed available is 29.3 r.p.m. which provides approximately a 46 ft. cutting speed on work 6 in. in diameter. The 16 spindle speeds are obtained through 18 gears, including the face plate, internal gear and pinion, without the use of either friction or jaw clutches. All speed changes are made through slip gears, the only ones in operation at any time being those that are transmitting power. By removing several of the driving units of the head, it can be simplified for use with an adjustable-speed motor, eight mechanical speeds being provided after the simplification.

The motor is mounted on the headstock and connected to the initial driving shaft by herringbone gears. The gears are fully enclosed and are continuously flooded with oil. The motor pinion is mounted on S K F ball bearings and is totally enclosed for the exclusion of dust and dirt.

The lathe is equipped with an automatic oiling system, the oil being pumped by a gear-driven Brown & Sharpe oil pump from a reservoir at the bottom of the head to a distributing chamber in the top cover. Before the oil reaches the bearings it passes through a filtering pad in the distributing chamber. It then drips into smaller reservoirs, from which it is fed through tubes to the various bearings.

The lathe is equipped with a hardened-steel multiple-disc starting clutch and brake which are incorporated in a detachable unit located in the driving pulley of the belt-driven lathes or in the large gear of motor-driven lathes. A mechanical apron control for operating the starting clutch and brake is operated by a lever at the right-hand side of the apron.

The bed lathe is of the American drop V type and is



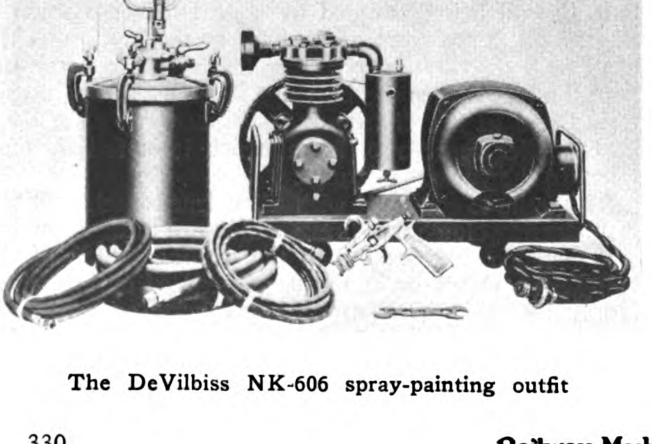
The American 30-in. lathe equipped with a 16-speed triple-geared head with face-plate drive

ribbed transversely with double-wall cross girths spaced 2 ft. apart. A rib is carried lengthwise in the center of the bed which has a rack cast integral with it. The tailstock is provided with a pawl which engages this rack for resisting the end thrust when heavy work is being turned. The tailstock is of the four-bolt design, the spindle being clamped in position by means of a double-plug binder.

Renewable bushings are fitted in all cylindrical members subject to wear. The spindle bearings are made in halfs with laminations between the cap and the head to permit taking up wear. The leadscrew, made of high carbon steel, is 2¼ in. in dia., one thread per inch.

DeVilbiss Complete Spray-Painting Outfit

A COMPLETE spray-painting outfit, especially designed to be operated by one man, has recently been placed on the market by the DeVilbiss Company, Toledo, Ohio. This outfit, known as the DeVilbiss NK-606, is electrically operated, is of light construction, and is designed to handle extensive maintenance work in stores, office buildings, railroad shops, etc., including



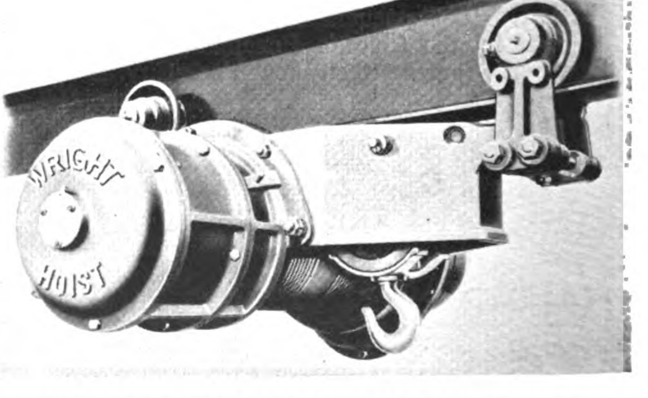
The DeVilbiss NK-606 spray-painting outfit

the finishing of interiors, furniture and equipment, etc.

The NK-606 outfit consists of a motor-driven compressing unit powered by a ½-hp. motor, mounted on a castor base, one pressure-feed spray gun, one 2-gal, pressure-feed paint tank, one 20-ft. length of $\frac{5}{16}$-in. air hose and connections, one 12-ft. length of ¼-in. braid-covered hose and connections, and one 12 ft. length of $\frac{5}{16}$-in. fluid hose and connections.

Wright WH Hoist For Low Headroom

THE Wright type WH electric hoist produced by the Wright Manufacturing Company, Bridgeport, Conn., is designed for low headroom installations. The minimum distance from the bottom of the I-beam to the hook of the one-half ton hoist is 11 in. and on the one-ton



The Wright WH hoist designed for low headroom installations

hoist, 13 in. The hoist is equipped with push-button or pendant-rope control, Tru-Lay cable, a safety-type limit switch, a safety-type load block, mechanical brake and

is also fitted with heat-treated forged gears and pinions.

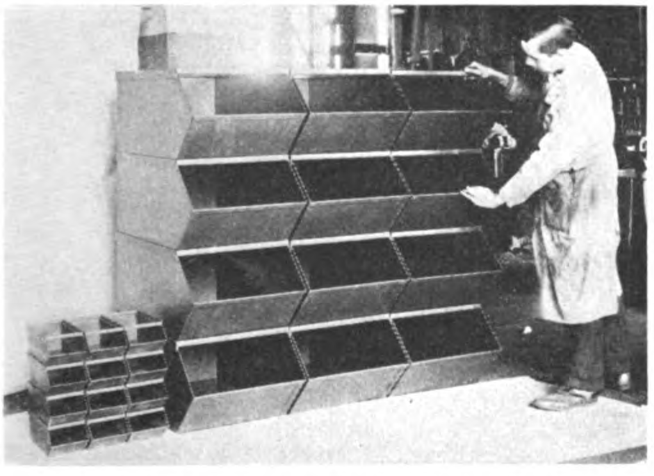
The drums of the hoist are full size and are not reduced to obtain the short distance from the bottom of the I-beam to the hook. They are 30 times the diameter of the Tru-Lay cable and are fitted with machine-cut grooves to prevent the cable from overlapping. The drum flanges are guarded so that the cable cannot wedge between the drum and the hoist frame.

The mechanical holding brake, adjustable from the outside, runs in oil, as do all the gears of the hoist. The motor, drums and drum-pinion bearings have Alemite fittings to prevent danger from oil leaking at these points.

Simplex Nesting Bins

THE sectional bins shown in the illustration, manufactured by Stackbin Corporation, Providence, R. I., and designated as Simplex Nesting bins, are designed for the storage of small parts used in assembling operations, for storing parts produced in quantity to reduce handling, and as storage bins in a stock room.

The bins can be stacked sectionally as illustrated. They are so fabricated that they will not unstack or cannot readily be dislodged when once placed in position. A seam is provided on the top for this purpose and each section must be lifted one out of the other. The metal edges where the hand enters the bin are bent over so that

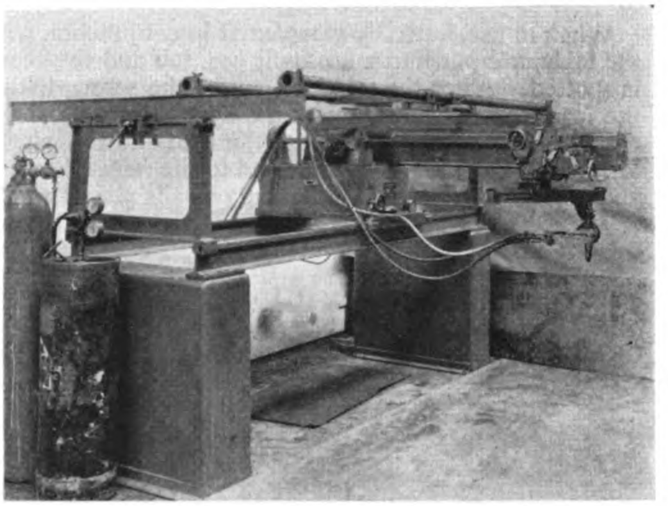


Sectional stacking of Simplex Nesting bins

a smooth rounded edge is presented. The bins are made in four sizes with the following dimensions: No. 1, 4 in. high by 5½ in. wide by 12 in. long; No. 2, 5¼ in. by 7½ in. by 15 in.; No. 3, 6½ in. by 9 in. by 18½ in.; No. 4, 9½ in. by 12 in. by 20 in. These sizes are standard but special sizes can be furnished to meet individual requirements.

Automatic Oxyacetylene Cutting Machine

IN the illustration is shown a combination compound transversing-head and template automatic oxyacetylene cutting machine which is designed to execute practically all forms of cuts. The machine is not simply of the template type, but can be used automatically without a template, with a template, or by hand guidance.



The transversing-head and template automatic oxyacetylene cutting machine

All parts of the machine which are not subject to wear are made of the light metal, Silumin (Alpox).

It has a built-in ¼-hp. motor which can be supplied in any voltage, cycle or phase and is directly connected to a stepless friction drive capable of moving the burner at any desired speed to suit the thickness of the metal. The speed is adjustable by means of a hand wheel and may be read from a tachometer placed above the machine where it can be seen by the operator at all times. All control levers are within easy reach of the operator to insure rapid manipulation of the machine.

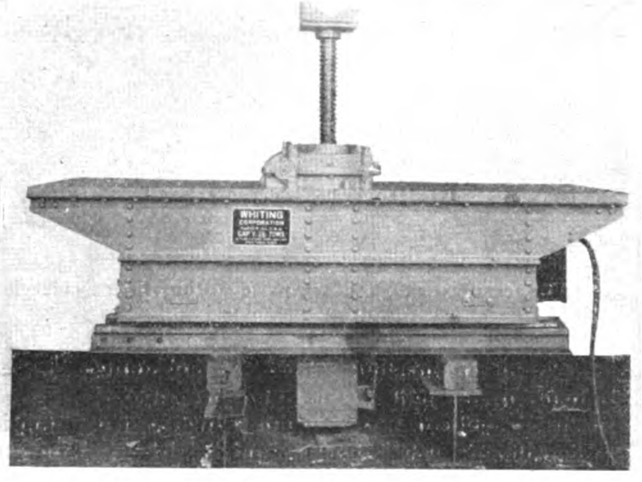
The cutting capacity of the machine is unlimited, as the whole machine moves along the track for cutting of this kind. There are a number in use in Germany with tracks 60 ft. long. The cross cuts are made by the torch holder moving in or out on the transverse head, which allows the machine to cut right angles, 45-deg. angles and straight lines, going from one kind of cut to the other by the turn of a lever and without interrupting the cutting. All circles are automatically made without a template by setting the circle gage for the proper size.

This machine is made in 39-in., 54-in. and 79-in. sizes, the difference being in the length of the transverse head. It is marketed by Jos. C. Paulus & Co., 2507 Potter street, Philadelphia, Pa.

The Whiting Single-Screw Drop-Pit Table

IN the illustration is shown a single-screw drop-pit table designed for use in the coach yard. It is the product of the Whiting Corporation, Harvey, Ill., and consists of a standard screw unit with a V-shaped block top which raises the wheels at their axle center. The screw is stationary but the block can be swiveled as desired. Only the worm-gear case is above the platform top; the motor and gear reductions are located beneath it. A dirt-proof case extends below the table, enclosing the screw at its lowest position. The screw nut and gear reductions are enclosed and operate in an oil bath. The screw is mounted on a solid structural frame fitted with trucks which are equipped with roller bearings. The screw of the table illustrated is operated by a 5-hp. motor, has a lift of approximately 40 in. and travels 16 in. per min. with a rated capacity of 15 tons. The secondary pit used in conjunction with the table is 24 in. deep.

When in use, butterfly gates, used in conjunction with the table, are put into a cross-pit position and the coach is spotted. After the table is spotted, the screw, lifting the load of one wheel, raises the spotted wheels above gates. The gates are swung to the wall and the wheels lowered. The table is then moved to the releasing track and wheels are raised and released on rails placed across



The Whiting single-screw drop table for passenger coach yards

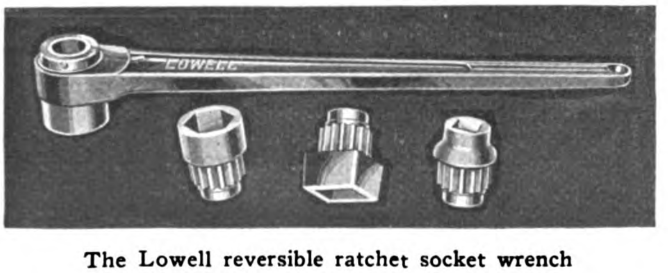
the pit. The table can be readily moved and can serve any number of coach tracks.

The screw is self-locking; when the motor stops the load stops, controlled by means of a Whiting push-button remote control. The platform top is made of heavy planks, extending the full width of the pit and well beyond the coach trucks on each side. This design provides a working platform on which men can stand while completing every job except moving the table.

The Lowell Reversible Ratchet Socket Wrench

THE reversible ratchet socket wrench shown in the illustration is a recent development of the Lowell Wrench Company, Worcester, Mass. The wrench has a 24-in. safety steel handle with interchangeable sockets having capacities of 5/8 in. to 1 1/4 in. square or hexagon nuts. The handle is made of electrically heat-treated metal and is designed with an improved grip to facilitate handling by the operator.

The wrench has enclosed pawls of hardened steel to increase the service life of the tool by the elimination of all dirt from the operating part of the wrench. The pawl mechanism itself is under a crushing stress throughout with no shearing stress. It can be reversed without being removed from the work by throwing a small shipper or reversing lever near the end of the handle. The



The Lowell reversible ratchet socket wrench

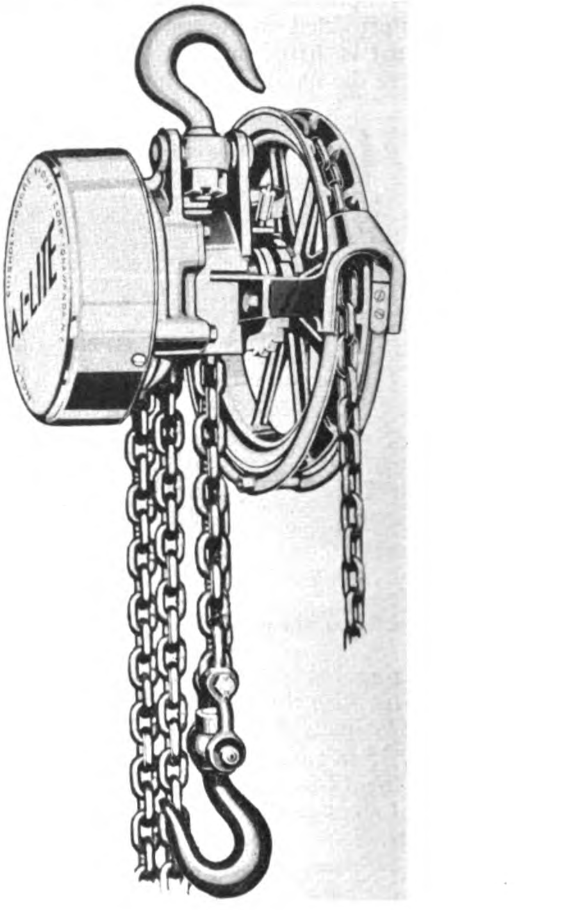
sockets are removable and interchangeable by taking off the retaining collar which allows the socket to slip out and the new one to be fitted in.

The tool can be used on locomotive frame work for drawing up fitted frame bolts, for tightening saddle bolts and steam-dome cap bolts and also in air-pump, feedwater-heater, stoker and booster repairs. It also serves as a general utility wrench for bolting pipe flanges on construction work, in enginehouses and on car construction.

Aluminum-Alloy Chain Hoist

THE Chisholm-Moore Hoist Corporation, Tonawanda, N. Y., is manufacturing a chain hoist constructed of aluminum alloy. The hoist, designated as the Al-Lite chain hoist, is designed to be one-third lighter than other chain hoists to enable one man to carry it and hang it in place.

The Al-Lite hoist is provided with Alemite lubrication, and is fitted with hardened and ground ball bearings, planetary type gears and a dust-proof housing adjustable brake. It is equipped with Inswell chain and is tested at 50 per cent overload.

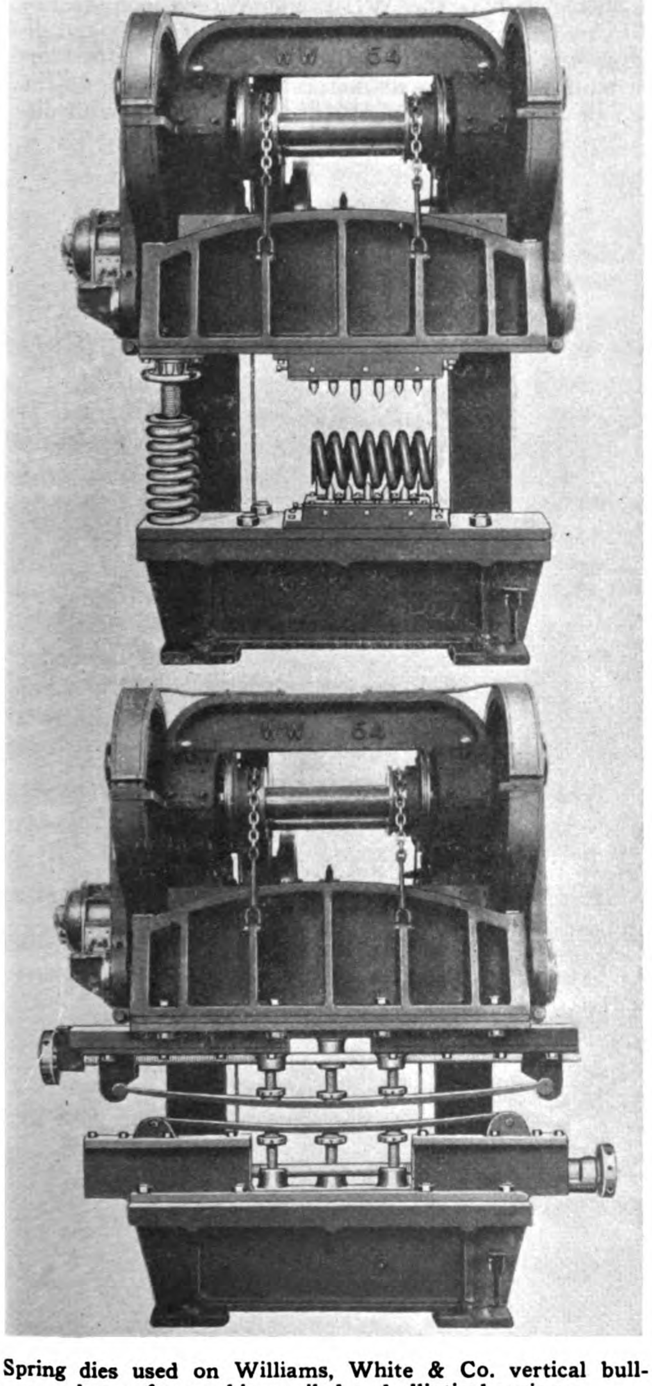


The Chisholm-Moore Al-Lite chain hoist

The hoist is made in 1/4-ton, 1/2-ton and 1-ton capacity sizes. The 1/4-ton size has a gross weight of 45 pounds and requires a 45-pound chain pull to the lift capacity load, 12 1/2 feet of chain being handled to lift the capacity load 1 foot.

Spring Dies For Vertical Bulldozer

IN conjunction with its vertical type bulldozer, Williams, White & Co., Moline, Ill., have recently brought out improved dies for reclaiming flat and coil springs for locomotives and cars. When using the dies for reconditioning coil springs, the spring is first heated, set in a horizontal position and spread slightly beyond its free working height. The spring is then set in a vertical position as illustrated, and on the down stroke of the ram it is brought to its finished length, after which it is tempered. The dies are adjusted by set screws and are so designed that the fingers each move the proper distance in relation to each other so that, when they are locked they are the same distance apart, thus requiring only one set of dies for various size coil springs.



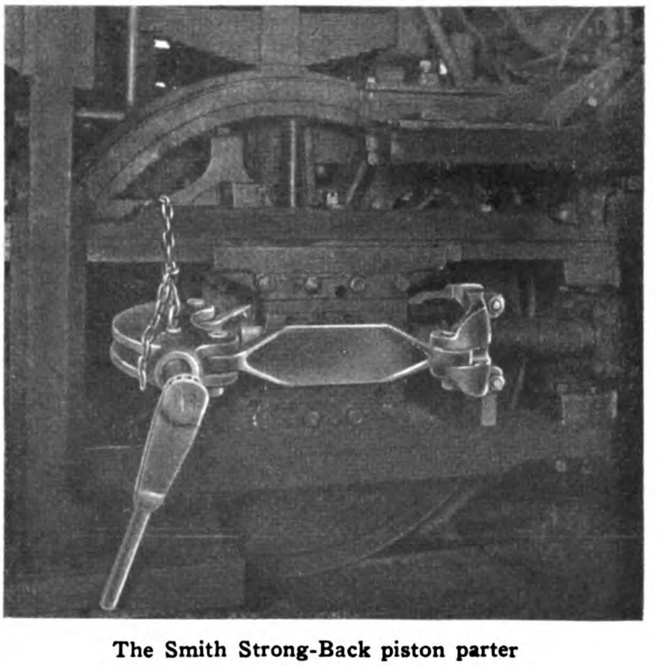
Spring dies used on Williams, White & Co. vertical bulldozers for working coiled and elliptical springs

In another illustration is shown a die which is designed for reclaiming flat and elliptical springs. The top die as shown is tempered practically straight so that it is necessary to pull the two ends together to get a radius. The bottom die is tempered with an excess radius and must be pulled apart to get the proper radius. The jack screws in the center are used simply for supporting the springs under load, it being necessary to loosen them to adjust the dies. The proper radius of the dies is secured by setting the jacks against a spring by hand, tightening or loosening the wheels as desired until the proper radius is reached. The spring leaves are worked while hot and are laid on the dies, the stroke of the machine setting them to the proper radius. When removed they are thrown in the tempered solution.

The machine on which the dies are used is made single or double-geared to operate at from 10 to 30 strokes per minute but it can be furnished with a two-speed drive to operate at 10 and 20 strokes per minute. The machine can also be furnished with a hand clutch control or with a treadle control, with an automatic stop at the top of the stroke. It is made in Nos. 53 and 54 sizes which have capacities of 50 and 85 tons, respectively.

Smith Tool for Parting Pistons

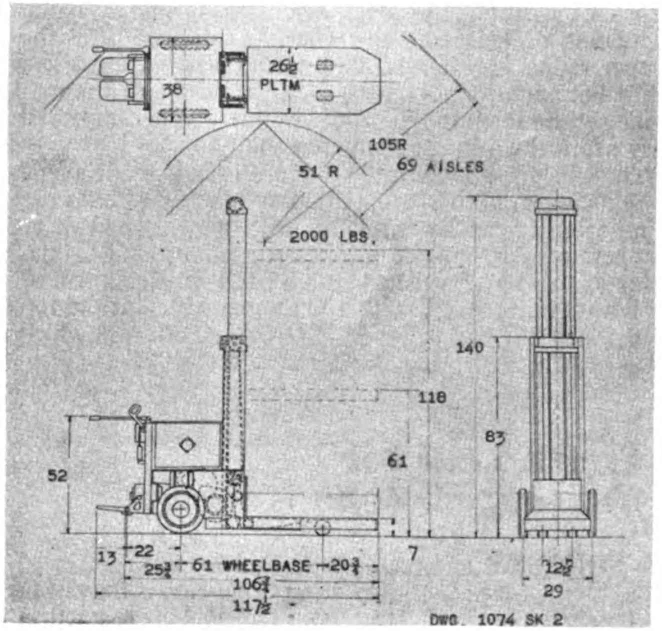
A RECENT addition to the Smith tools, produced by the Clark Manufacturing Company, is the piston parter shown in the illustration. This tool is designed so that in parting the piston the bell of the crosshead takes the full pressure of the load. The tool, designated as the Strong-Back piston parter, is constructed of a yoke which fits over the bell of the crosshead, a yoke hung from the top guide back of the crosshead and two connected sections which parallel the crosshead sides. Fitted to the rear yoke is a hydraulic cylinder and piston operated by a ratchet wrench, the piston of which is set against the end of the locomotive piston rod. As pressure is applied the load is taken by the yoke set against the bell of the crosshead. The tool develops 150 tons pressure and is designed for parting rods from the smallest to the largest sizes.



The Smith Strong-Back piston parter

Elwell-Parker High-Lift Truck

THE Elwell-Parker Electric Company, Cleveland, Ohio, recently brought out a high-lift tiering electric truck with telescoping uprights. It is designed for placing loads in tiers or stacks and for loading or unloading cars from rail level, loading or unloading motor trucks from street level, icing cars, etc.



Drawing showing the dimensions and operating limits of the Elwell-Parker high-lift truck

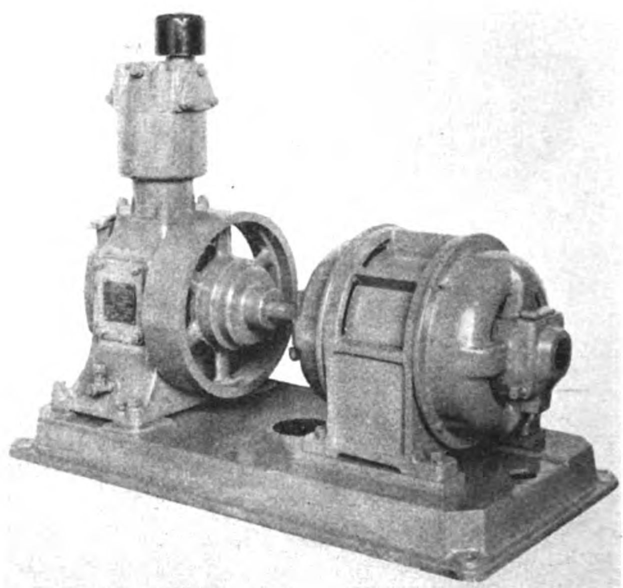
The electric truck illustrated is 3 ft. 2 in. wide, 9 ft. 4 in. long with a 26 in. by 54 in. platform that tiers in the open to a height of 10 ft. yet will pick up its load of 4,000 lb. at 7 in. above the floor in a railroad car with 83 in. inside height. It is designed with primary and secondary uprights, the latter of which does not begin to rise until the platform reaches a height of 61 in. This feature enables the truck to stack merchandise to the roof of a box car. The truck is capable of elevating a load to a height of 118 in., but with the uprights in a lower position, it may be driven through a 7 ft. door, 42 in. wide. Independent control of brake and power for ramp performance is employed. The travel, hoist and tilting or auxiliary loading and unloading attachments are all driven by fuseless motors.

The truck steers on all four rubber tired wheels and is designed to operate in 70-in. aisles. It is equipped with standard automatic safety control of travel and hoist motors, and with cable lift, automatic elevating, hoist limit, cutouts, and either Edison or Exide batteries or Ready Power gas-electric equipment.

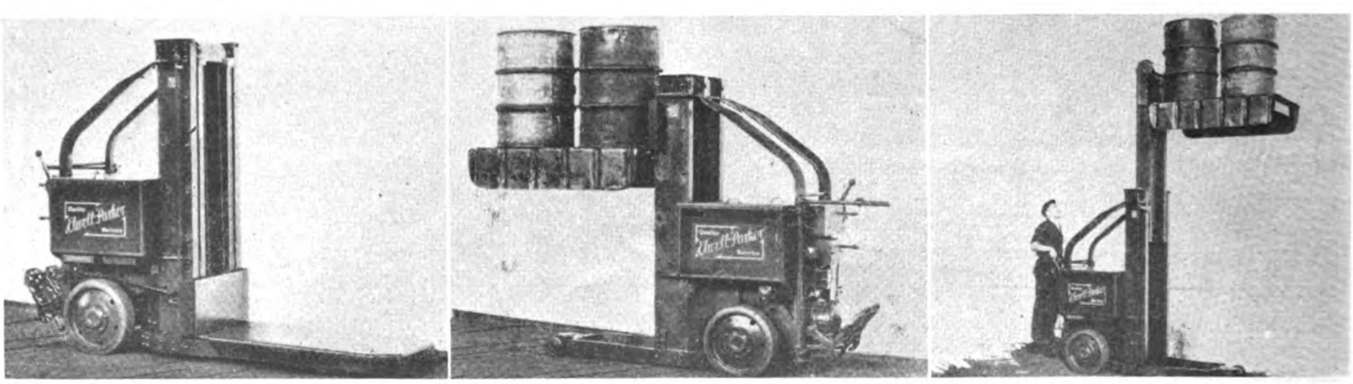
The truck is built in sizes of 3,000, 4,000 or 6,000 lb. capacity sizes and with platforms 7 in. or 11 in. high.

Sullivan Single-Acting Air Compressors

THE Sullivan Machinery Company, 400 North Michigan avenue, Chicago, has recently introduced two single-cylinder, single-acting vertical air compressors, supplementing its two-cylinder and four-cylinder units of the same general types. These compressors are designated as the WL-1 and WL-11 compressors and can be furnished for belt or V-belt drive and direct-motor drive. The belt-driven WL-1 compressors are built with piston diameters and strokes of 5½ in. by 5 in. and 6½ in. by 5¼ in., respectively, with displacements ranging from 27 to 62 and 40 to 91 cu. ft. of free air per min., respectively, with speed variations of 400 to 900 r.p.m. When V-belt drive is desired a sub-base is available on which the compressor motor



The Sullivan W-11 single-acting air compressor



The Elwell-Parker high-lift tiering truck of 4,000-lb. capacity designed with telescoping uprights for elevating its load to a height of 118 in.

and V-belt drive are mounted. The W-11 direct-connected motor-driven units, with a 60-cycle a. c. motor, are built in sizes having capacities of 60 and 88 cu. ft, of free air per min., respectively. Twenty-five-cycle a. c. motors and d. c. motors may also be furnished if desired.

Both the belted and direct-connected models can be equipped with automatic start and stop control for either wide or close regulation, as required by service conditions. The larger of the two belt-driven units occupies 19-in. by 21-in. floor space and is 43 in. in height. The WL-11 units, including motor and sub-base, are 53 in. long by 27 in. wide, with an overall height of 47½ in. Both units are capable of maintaining a maximum air pressure of 125 lb. per sq. in.

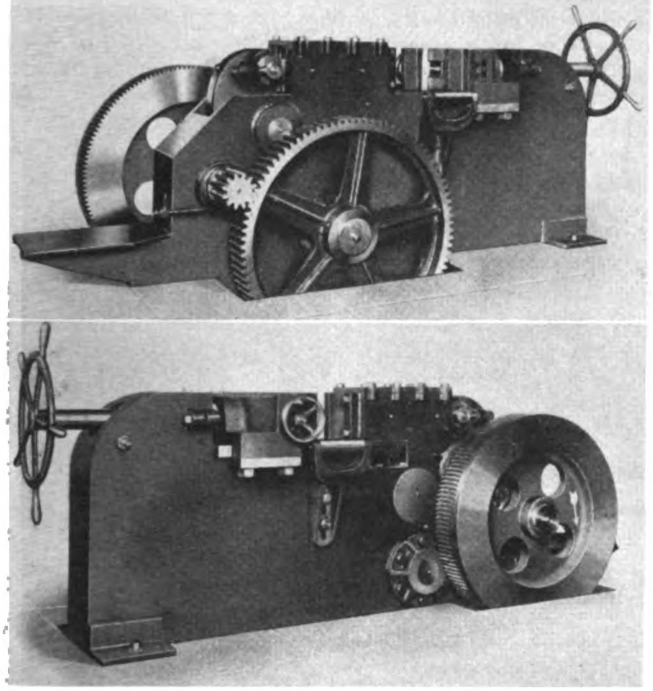
The units are equipped with Sullivan automatic water valves of stainless steel, providing low lift with wide port opening, and a small clearance factor.

Buffalo Armor-Plate Straightening Machine

A MACHINE designed along the lines of a horizontal punch for straightening axles, rails, beams, channels, tees, etc., has recently been placed on the market by the Buffalo Forge Company, Buffalo, N. Y. The machine is fitted with pressure blocks which are adjusted by means of a hand-wheel and which move in unison to insure equal spacing. The carriage of the machine is graduated and capacity tables are furnished to indicate what sections may be bent on any given centers. The carriage is adjusted by means of a large hand-wheel and heavy screw. The adjustment is sufficient to permit sections of maximum size between the pressure blocks. Operation of the machine is continuous, there being no gags or clutches.

The plunger slides between the frames and is gibbed on both sides with bronze liners. The three pressure blocks are of hardened alloy steel and their standard shape may be changed to suit special conditions. The machine is provided with rollers to facilitate the handling of different materials as they pass through the machine.

One of the features of the machine is the Armor-Plate electrically welded frame which is guaranteed against breakage. The table is a heavy steel plate welded between the frames. The gear is a steel casting while the pinion is a nickel-steel forging, cut teeth being used throughout. The shafts are alloy-steel forgings. The machine is Alemite lubricated throughout except the flywheel bearing which is of the ring-oiling type. The machine is made in three sizes, No. 47, 48 and 50 respectively, the specifications of which are given in the table.



Buffalo machine for straightening axles, rails, beams, etc.

Self-Propelled Riveting Truck

AN unusual application of the industrial-truck principle to cut production costs is the self-propelled riveting truck recently developed by the Mercury Manufacturing Company, Chicago. The design is known as the Mercury ES-513 rivet-press carrying truck. The truck is 55 in. wide by 76 in. long and carries a tower structure 114 in. high. The tower supports an I-beam that extends 95 in. each side of the tower center. Chain block trolleys which carry portable pneumatic riveting presses of 25 tons capacity ride on this beam.

The riveting truck is operated by a 220-volt d.c. motor which drives it through a worm-driven rear axle. The current is brought to the truck by a cable on a take-up reel. The cable is arranged to be plugged into a standard 220-volt supply line which is available where the truck is being used. There are two speeds forward and two reverse.

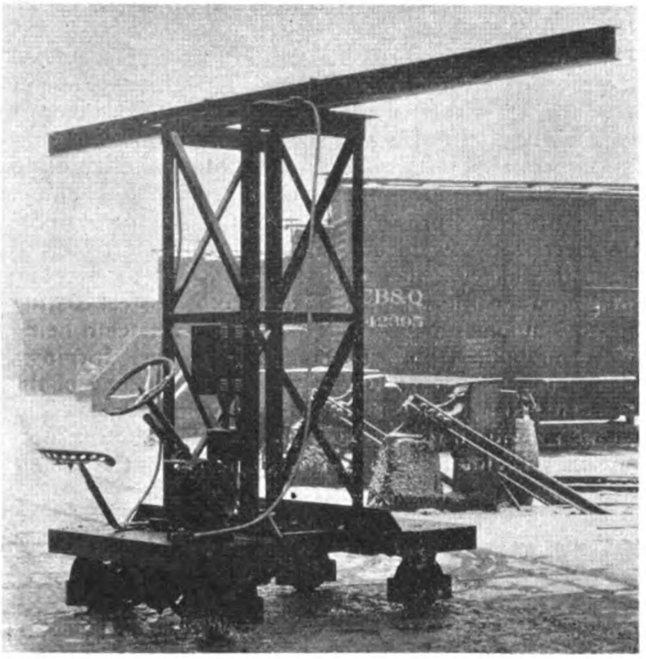
When in use the truck carrying the two riveting presses is slowly moved up and down the aisleways where routine rivet work is being done or where structural beams are being fabricated. A crew of men

Capacities of Buffalo Straightening Machines

No. of Machine	47	48	50
Distance between blocks	6 in. to 14 in.	8 in. to 16 in.	8 in. to 18 in.
Straightens beams up to	6 in. to 17.25 lb.	9 in. to 30 lb.	10 in. to 35 lb.
Straightens channels up to	7 in. to 19.75 lb.	10 in. to 35 lb.	12 in. to 35 lb.
Straightens angles up to	5 in. by 5 in. by ¾ in.	6 in. by 6 in. by 1 in.	8 in. by 8 in. by 1 in.
Straightens angles up to	6 in. by 4 in. by ⅝ in.	8 in. by 6 in. by ¾ in.	8 in. by 6 in. by 1 in.
Straightens tees up to	all	all	all
Maximum section modulus	9.5	23.1	29.9
Ram pressure	80 tons	130 tons	190 tons
Number of strokes per minute	40	35	35
Height of strokes	1 in.	1⅛ in.	1¼ in.
R.p.m. of flywheel	300	300	300
Pulleys	18 in. by 3 in.	20 in. by 4 in.	26 in. by 4 in.
Hp. of motor	5	7.5	10
Length	9 ft. 6 in.	11 ft. 6 in.	13 ft. 6 in.
Width	2 ft. 10 in.	3 ft. 4 in.	4 ft. 0 in.
Height	2 ft. 3 in.	5 ft. 0 in.	6 ft. 3 in.
Weight	6,850 lb.	11,000 lb.	16,500 lb.

working on either side can move the press easily and conveniently to the exact location where the rivets are to be driven. The speed of travel of the riveting truck is controlled by push-button stations carried on the belt of one of the men working on the riveting press. In this way a very convenient and rapid handling of the riveting operations is obtained.

When the truck has to be moved over a longer distance than normal, the operators can take their places



The Mercury ES-513 self-propelled truck for carrying riveting presses

on the machine and drive the truck at three or four miles an hour. The truck is provided with special guards which push discarded rivets and scrap metal out of the way as the truck travels.

Attachments for the Ohio Super-Dreadnaught Shaper

SINCE the 36-in. Ohio Super-Dreadnaught shaper was placed on the market, four new attachments have been developed by the Ohio Machine Tool Company, Kenton, Ohio, adapting this tool to a more diversified service on locomotive repair work.

With the shell or crown-brass attachment, illustrated in Fig. 1, any size brass can be machined to a smooth finished surface of any radius. This fixture is fitted with machine surfaces for the use of gages and can be operated either by hand or power. This method of shaping a shell permits a tighter fit in the driving box. The average time required on normal size driving-box crown brass as established by tests is 30 min. floor-to-floor time.

The shoe and wedge chuck, shown in Fig. 2, is made in two sections for easy handling and is universal in that various types and sizes of shoes and wedges can be held on it. It can be adjusted on the shaper table to suit requirements of the job. There are screws in the lower section which can be adjusted to obtain different angles for machining the shoes and wedge. A check of time in using this attachment showed 20 min. each for machining cast-iron shoes and wedges, 6¾ in. wide by 22 in. long, including shaping the box face to line and filleting two corners.

The illustration shown in Fig. 3 is a main-rod brass attachment. There are absolute stops for every 90-deg. turn of the attachment so that work can be planed square without referring to the graduated dial. If it is necessary to plane a brass to any intermediate degree, it is only necessary to revolve it to the degree

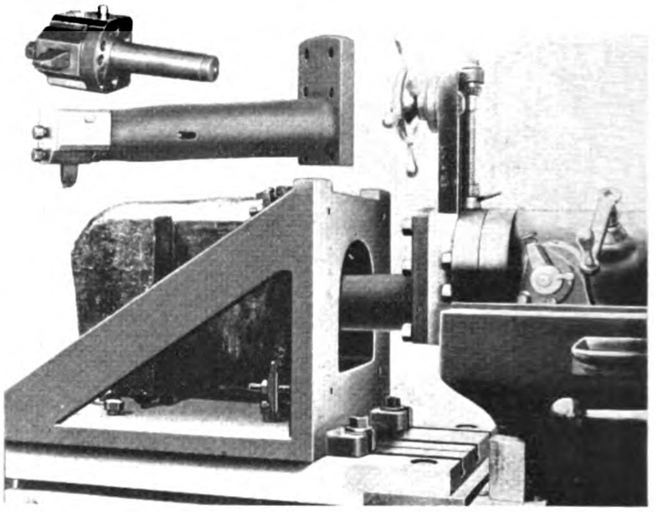


Fig. 4—The fixtures and head for machining electric locomotive driving-wheel boxes for roller-bearing fits

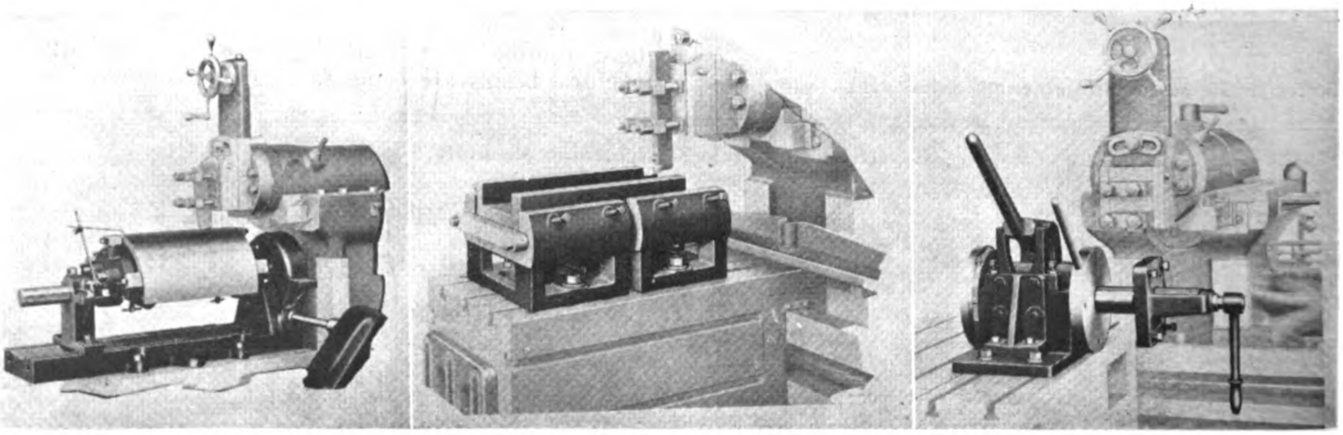


Fig. 1, Left: The crown brass attachment—Fig. 2, Center: The shoe and wedge chuck—Fig. 3, Right: The main-rod brass attachment

required and pull down the locking lever. The reported test time for machining a main rod brass with a 6-in. jaw is 25 min., including shaping the wedge fit, ends and sides, finishing the top of the flange and shaping the strap fit.

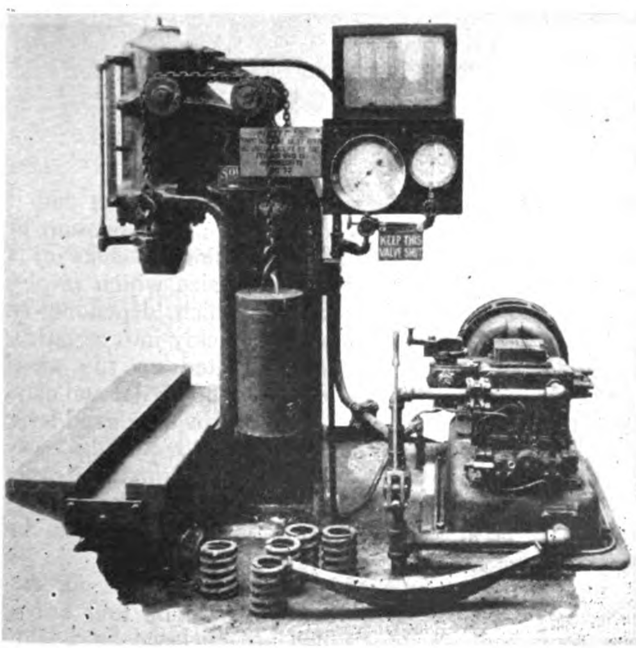
Fig. 4 shows fixtures and a head for machining electric-locomotive driving-wheel boxes for roller-bearing fits. Tools and fixtures adaptable to all classes of electric motor cars can be furnished. These attachments can be secured from Joseph T. Ryerson & Son, Inc., general distributors of Ohio shapers.

Ryerson Machine for Testing Springs

A MACHINE for testing all types of railroad springs has been designed recently for the New York, New Haven & Hartford by Jos. T. Ryerson & Son, Inc., Chicago. This special spring tester, which is in use in the Van Nest shops, New York, embodies several outstanding features. The machine is operated by hydraulic pressure furnished by a self-contained motor-driven Oilgear unit which is mounted on the machine, instead of by an accumulator, thus saving floor space otherwise required by the accumulator and connecting pipes. In spring testing work it is often desirable to hold a spring under pressure for a specified length of time in order to provide a more accurate test. Through the use of the Oilgear system a spring may be held deflected at any desired pressure for three or four minutes at a time. A maximum pressure of 50 tons is developed at 1,500 lb. per sq. in.

The machine is arranged for testing full-elliptic springs for passenger cars as well as semi-elliptic locomotive and coil springs. The frame has an 11-in. throat and a work table 25-in. wide which makes it practical for testing these varied types of railroad springs. Both the frame and the work table are made of cast steel, offering ample resistance against the heavy loads imposed upon them.

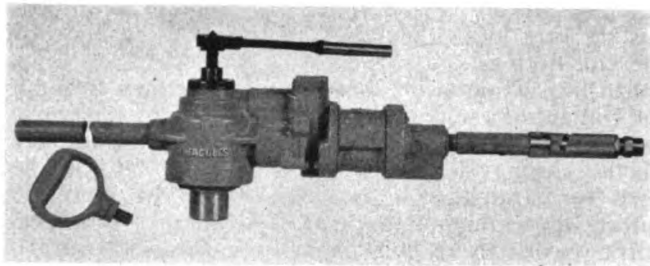
A scale is mounted on the overhead ram cylinder to indicate the deflection of the spring being tested. As the ram moves down, deflecting the spring, an adjustable pointer moves with it and shows the exact deflection on the scale. A large pressure gage, having two dial readings, indicates the pressure in pounds per square inch and the total pressure of the ram in pounds.



Ryerson machine for testing elliptical and coil springs

Hercules Heavy-Duty Drill and Reamer

THE Buckeye Portable Tool Company, Dayton, Ohio, has added to its present line of Hercules portable air tools a heavy-duty drill and reamer of exceptionally light weight. This tool is also made for nut driving, and is designed for structural steel work, ship building, railroad shops, and builders of heavy machinery. Its weight is 40 lb., which is approximately half of the usual weight of tools of its capacity.



The Hercules No. 287-5 heavy-duty drill

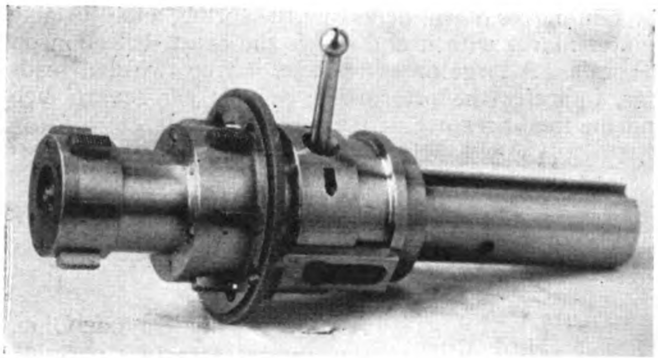
The No. 287-3 drill and No. 288-3 nut driver have a speed of 120 r.p.m. The No. 287-5 drill and No. 288-5 nut driver have a speed of 68 r.p.m. The drill is equipped with a No. 5 Morse taper socket and the nut driver with a ⅞-in. square spindle. The feed is controlled by a ratchet wrench, although a spade handle or breast plate can be used in place of the rachet. The Hercules stationary-valve motor is used to give this tool the greatest torque possible at its speed. The tool illustrated is the No. 287-5 drill.

Combination Geometric Collapsing Tap

THE Geometric Tool Company, New Haven, Conn. has recently developed a special combination collapsing tap for cutting two diameters at one time. The tap illustrated is known as a 3-in. and 4-in. Class SD Tap, being equipped to cut 3$\frac{11}{16}$ in.—12 U. S. threads and 4⅝ in.—12 U. S. threads at the same time. The chasers engage with the work simultaneously, or at such pre-arranged points as is necessary in order for the chasers to finish threading at the same time.

In using a tap of this kind, the pitch of the two threads and 4⅝ in.—12 U. S. threads at the same time, must be far enough apart to permit the use of two sets of chaser slots and also two complete plungers for holding the chasers in the tool, but not so far apart as to cause excessive overhang.

While the tool is used in a stationary machine as a plate trip, hand reset type, it can be installed on a chucking machine used as a rotary top plate trip, automatic reset. In other words, it has the universal application such as found in the standard line of Geometric Class S taps.



The Geometric class SD 3-in. and 4-in. collapsing tap

The chasers have independent size adjustment. Those in front are adjusted through the medium of an adjusting ring located on the back part of the body of the tap. Both sets of chasers collapse at the same time, collapsing action being brought about either through the contact of the trip plate with the face of the work, or through the use of a fork operating in the groove of the closing sleeve. This combination tap can be used for straight hole tapping, or can be used for cutting taper threads, such as pipe threads, thus permitting work to be done in a single operation, which formerly required two operations.

The Cesco M & L Goggles

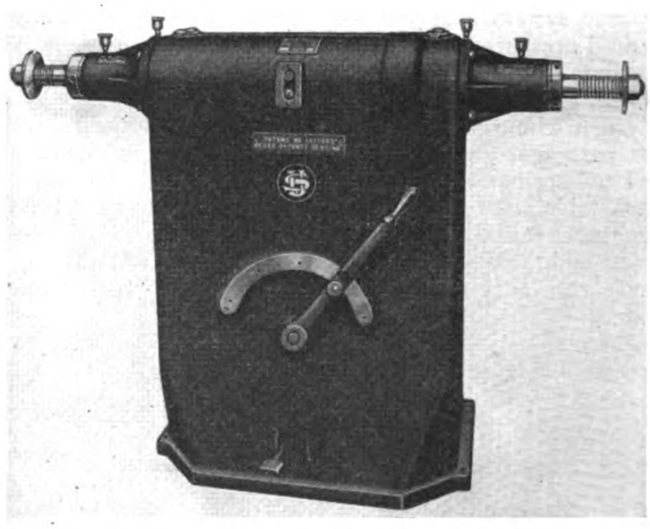
THE Chicago Eye Shield Company, 2300 Warren boulevard, Chicago, Ill., recently placed on the market a pair of goggles designed to fit over a workman's glasses. The channels of the goggles are shaped to prevent pressure on the workman's temples, and the cups are tapered to allow them to fit over the largest spectacles. The cups extend over the nosebridge to prevent foreign matter from entering the eye. The nosebridge and headbands are so shaped as to permit adjustment to any face, while the inner part of the cup fits over the nosebridge in such a manner as not to interfere with adjustment or focus. The goggles are made of moisture-proof composition material and are standardized so as to permit the interchangeability of parts.

The Cesco M & L goggles for fitting over workmen's spectacles

The goggles are furnished in the following three styles to meet various requirements: A ventilated pattern fitted with Super-safety lenses for chipping, grinding, caulking, riveting and like operations; a dust model fitted with Super-Safety lenses, and a welders' pattern fitted with Cescoweld lenses for acetylene welding and cutting.

U. S. Multispeed Buffer and Polisher

THE United States Electrical Tool Company, Cincinnati, Ohio, recently added to its line of products its Multispeed buffer and grinder which is provided with four different wheel speeds ranging from 2,000 r.p.m. to 3,000 r.p.m. The machine maintains a constant wheel-surface speed regardless of wheel wear and is driven by means of a Gibbs V-disc transmission of graphitized micarta. The transmission consists of a cone or series of discs of different size which revolve on the motor spindle, any one of which, depending on the speed desired, can be inserted quickly into a stationary metal V-disc or sheave, mounted on the wheel spindle, by releasing the cone with a foot pedal and moving it into the desired position by means of a hand lever on the front of the machine. The motor and disc cone are mounted on a rocker arm so that they may be easily moved along the mounting, parallel with the wheel spindle. Changes in speed are made only when the motor and wheels are not in motion.



The U. S. Multispeed buffer and polisher

The buffer consists of a heavy one-piece chrome-manganese-steel wheel spindle supported on four heavy-duty SKF ball bearings which are enclosed by a laby-

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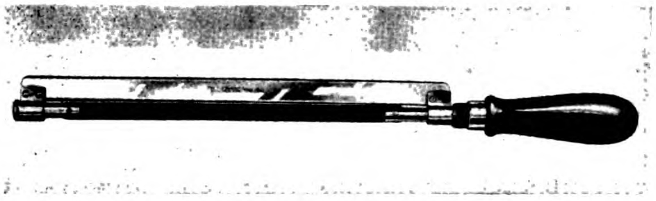
rinth seal in dust-tight grease compartments. The motor is built for continuous service and is of 40-deg. rating with a momentary overload capacity. The machine is controlled by a push button mounted near the top of the machine, within easy reach of the operator. The control has overload protection and no-voltage release.

Starrett Shallow Hacksaw Frame

A HACKSAW frame of unusual design has recently been introduced by the L. S. Starrett Company, Athol, Mass. The frame, shown in the illustration, has a throat just deep enough to accommodate the blade, with



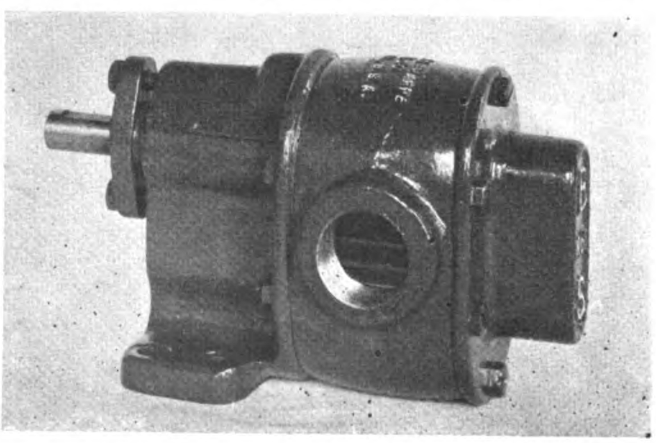
The Starrett No. 150 shallow-throated hacksaw frame

the result that cuts can be made in spaces offering hardly more than 1 in. clearance. This construction also results in improved balance and rigidity, making the frame adaptable for cutting small pipe, conduit, BX tubing, insulation, etc. The frame has no tendency to wobble on shallow cuts of this kind, blades can be strained tighter with less danger of breakage, and the cut can be made with one hand, with the other hand free to steady the work.

This hacksaw frame, designated as No. 150, is fitted with the usual Starrett four-way blade adjustment.

Brown & Sharpe Geared Coolant Pump

THE Brown & Sharpe Manufacturing Company, Providence, R. I., is prepared to furnish a pump of larger capacity than the Nos. 1, 2 and 3 gear pumps regularly in its line. This pump, which is known as



The Brown & Sharpe No. 4 geared coolant pump

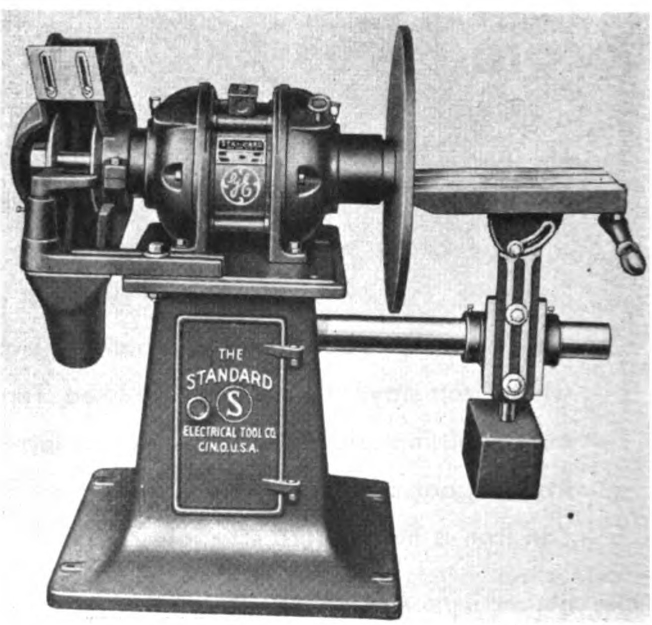
the No. 4, has a capacity of 15 gals. per min. at 500 r.p.m., with a corresponding increase in discharge of 3 gals, per min. for each 100 r.p.m. increase up to a maximum of 30 gal. per min at 1,000 r.p.m. Suction and discharge ports of 1¼-in. pipe size provide for the most favorable handling of this volume of liquid.

The No. 4 pump is of the same design and construction as the other pumps and is adaptable as a coolant pump for machine tools, as its capacity permits of a copious supply of coolant, either under pressure where such may be desirable as for drilling and flushing out chips, or where a cascade of coolant is desired without pressure. For larger machinery it can be used as a lubricating pump. For use independently it may be furnished electrically driven. Any of the pump accessories, except relief valves, available for the Nos. 1, 2 and 3 Brown & Sharpe geared pumps may be used with the No. 4 pump.

Combination Floor and Disc Grinder

THE combination electrically-driven grinder and disc grinder is a recent development of the Standard Electrical Tool Company, Cincinnati, Ohio, and is manufactured in three sizes. The 3-hp. machine carries emery wheels on one side 14 in. diam. by 2 in. face, with 1⅛-in. bore. On the opposite side it carries a steel disc 14 in. in diameter by ½ in. thick. The 5-hp. machine carries emery wheels 18 in. diam. by 3-in. face and an 18-in. steel disc ⅝-in. thick. The 7½-hp. machine has 20-in. by 3-in. emery wheels and a steel disc 20 in. in diameter and ¾ in. thick.

General Electric completely-enclosed motors with push-button controls are used. The spindles are mounted in SKF ball bearings with an extra SKF ball thrust bearing to take care of the end thrust created by the load on the steel disc. All of these bearings run in oil and are mounted in dust-proof chambers. The spindle is made of nickel steel. The table on the machine is of the lever-feed type and may be adjusted to any angle.



The Standard combination floor and disc grinder

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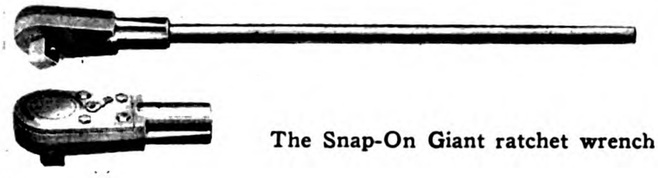
Snap-On Ratchet and Boxocket Wrenches

THE Motor Specialty Company, distributors, 2025 Michigan avenue, Chicago, has recently added to its line the Giant ratchet wrench and the heavy-duty Boxocket wrench shown in the illustrations, both of which are manufactured by Snap-On Tools, Incorporated, Kenosha, Wis. The head of the Giant ratchet



The Snap-On Giant ratchet wrench

wrench is detachable from the handle and is a solid forging with one cover plate which is bolted on the back. A smaller level is provided for reversing the action of the ratchet. The handle is a 32 in. solid round bar of heat-treated high-carbon steel and is attached to the head

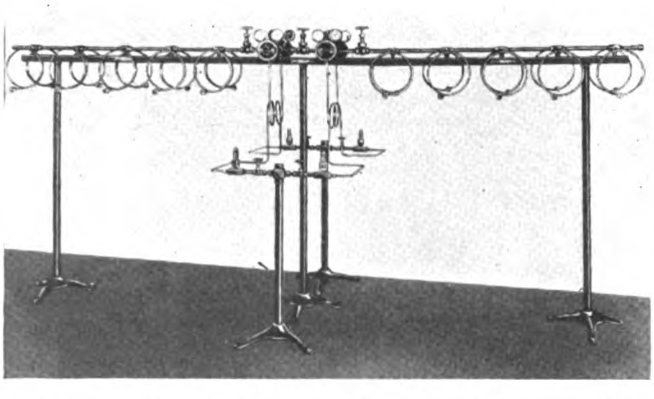
The Snap-On heavy-duty Boxocket wrench

by means of a locking button designed to prevent slipping under load.

The heavy duty Boxocket wrench is designed to fit over nuts in such a manner that the wrench will not slip. The head locks on a tubular handle by means of a safety locking button and is made in straight and offset styles. The wrench head, made in 44 sizes to fit on tubular handles of six different lengths, is especially applicable for tightening and loosening all sizes of boiler plugs, the design of the head reducing to a minimum the danger of rounding off the heads of the plugs by wrench slippage.

The Milburn Twenty-Tank Central Manifold

THE Alexander Milburn Company, 1416 West Baltimore street, Baltimore, Md., has brought out a twenty-tank manifold, shown in the illustration. These manifolds are constructed of bronze tubing, Milburn



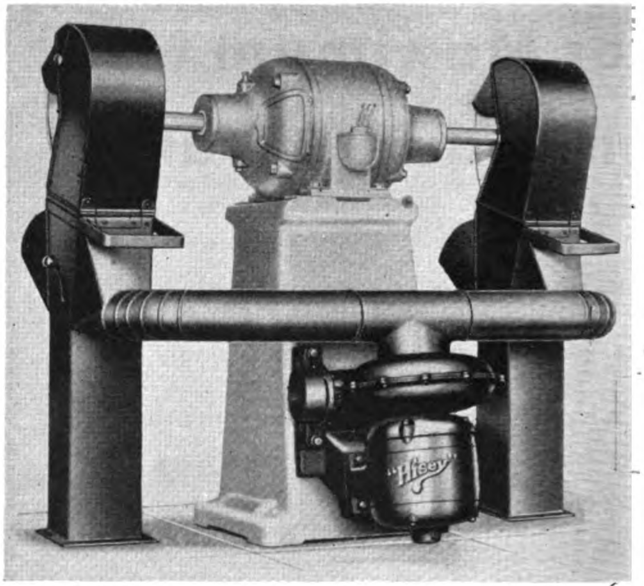
The Milburn twenty-tank manifold used to form a source of supply for cutting and welding torches

standard gas regulators and copper coils. Mounted on a tripod, they form a central source of supply for cutting and welding torches and are used to eliminate the necessity of transporting cylinders about the plant. With them it is possible to maintain an economical and uniform pressure for all operations.

An outstanding feature of the Milburn manifold is that, if desired, each tank or each side of the manifold may be operated independently through separate shut-off valves, thus allowing the torches to continue in operation while the tanks are being connected or disconnected.

Exhaust Equipment For Hisey Buffing Machines

IN the illustration is shown a motor-driven exhaust blower mounted integrally with a Hisey-Wolf polishing and buffing machine. This exhauster has been adopted by the Hisey-Wolf Machine Company, Cin-



The exhauster equipment used with Hisey-Wolf buffing and polishing machines

cinnati, Ohio, as standard equipment on its machines, to be furnished when specified by the purchaser of the equipment. The equipment also includes dust-collecting hoods on the smaller size machines and combination exhaust guards on the larger machines. A filter cabinet, which is used to collect grit and dust, can be supplied when specified.

Ready-Power Units Equipped with Ford Engines

A LINE of gas-electric industrial-truck power plants, in which Ford Model A engines are used, has been developed by the Ready-Power Company, 3820 Grand River avenue, Detroit. These models simplify the servicing of the engine because of the widely available parts service, and the low parts prices.

Two types of Ford engined power plants are offered: One, the FAS line, is equipped for electric starting and ignition, using a six-volt battery, and the other, the

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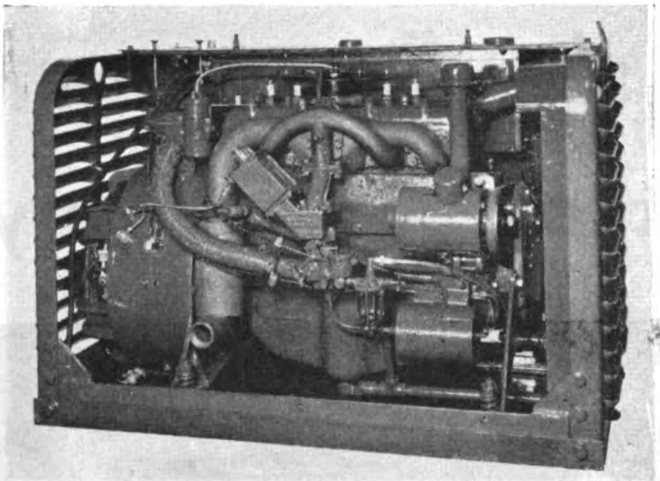
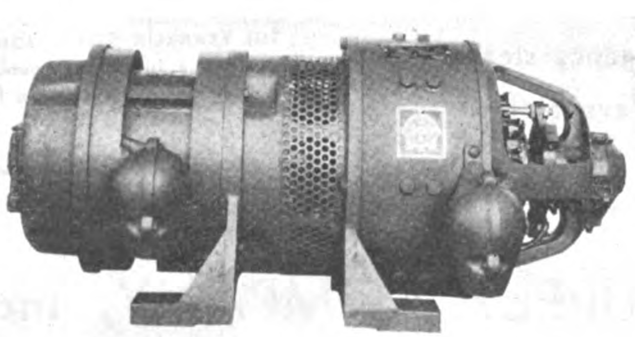


The Ready-Power gas-electric industrial-truck power plant equipped with the Ford Model A engine

FAM line, uses simple magneto ignition. The power generator is wound either for 36 or 48 volts. The model designations for the 36-volt starter and magneto equipped units are FAS-36 and FAM-36, respectively, while the 48-volt units for the starter and magneto equipped plants are FAS-48 and FAM-48, respectively. These models are offered in addition to the standard line of type DB Continental engined units which have been in production for five years.

Reliance One-Unit Motor-Generator Set

A ONE-UNIT motor-generator set for rates from 1 kw. to 5 kw. is shown in the illustration. In this set the usual alternating-current motor and direct-current generator are combined in a single unit requiring only two bearings, one at each end. The induction-motor rotor and direct-current armature are mounted on the same shaft. This design was adopted to provide a compact construction which would require less space than the two-unit sets, and which would eliminate the work of connecting and alining individual units and difficulties arising therefrom. The set, which is the product of the Reliance Electric & Engineering Company, 1088 Ivanhoe road, Cleveland, Ohio, can be furnished for operation on either two-or three-phase circuits of any standard voltage or frequency and has an output rating of 1 kw. to 5 kw. at 125 or 250 volts. It can be furnished with either sleeve or ball bearings as desired.

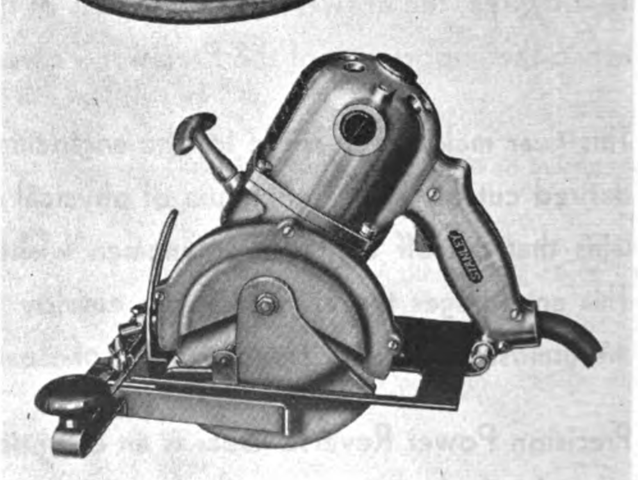


The Reliance one-unit motor-generator set

Stanley Disc Sander And Electric Saw

THE Stanley Electric Tool Company, New Britain, Conn., has recently brought out the portable electric tools shown in the illustration. The disc sander, designated as the No. 589 9-in. sander, is designed for sanding and cleaning wood or metal preparatory to painting, and also for rubbing and polishing lacquered surfaces. It has an aluminum alloy housing and is powered by a totally enclosed Universal motor fitted with seal-type ball bearings on the armature shaft and spindle to exclude dirt and retain the lubricant. The disc is 9 in. in diameter, is flexible and is designed to permit attaching sanding discs, polishing pads or a lamb's wool buffing bonnet. The disc speed under full load is approximately 1,800 r.p.m. The sanders are made with 110-, 220- or 250-volt motors, and include 12 abrasive discs (six coarse, four medium and two fine).

The Stanley Safety saw No. W6 6-in. weighs 14 lb., has a cutting capacity of 1⅞ in. and a maximum speed



Above: The Stanley No. 589-9 in. disc sander—Below: The No. W6 6-in. Safety saw

of 3,000 r.p.m. It is designed for cutting light lumber, ripping flooring and for miscellaneous cutting on freight-car repairs. The saw has an aluminum-alloy housing; a lubricating system for pumping oil to the worm drive and gears; a momentary-contact double-pole switch, and a guard which covers the blade when the saw is disengaged; a notched base and auxiliary handle to aid the operator in following the cutting line.

(Continued on next left-hand page)

Among the
Clubs and Associations

A.S.T.M. Exhibit.—For the first time in its history, the American Society for Testing Materials will sponsor an exhibit of testing apparatus and machines in conjunction with the annual meeting of the society to be held at the Stevens Hotel, Chicago, June 22-26. The exhibit has been planned with a view to having a distinctly scientific and broadly educational atmosphere, and manufacturers, distributors, and representatives of foreign companies will have equipment on display.

International Railway Fuel Association.—The annual meeting of the International Railway Fuel Association, usually held in May, has been postponed this year until the third week in September, when a two-day business session will be held, without exhibition or entertainment features. The decision to hold this meeting, which is scheduled for September 15 and 16 at the Hotel Sherman, Chicago, was made at a meeting of the executive committee of the association at Cincinnati, Ohio, on May 11. It was the conclusion of the committee that economies in the purchase, handling and use of railway fuel are of more than ordinary importance at the present time; that the International Railway Fuel Association has, in the past, contributed substantially to fuel conservation progress on the railroads, and that to forego the annual meeting of the association this year would be to lose much ground already gained, to overlook an opportunity for still further reductions in operating expense. In deference to present reduced business activity and the urgent necessity for economy, it was decided to cut the annual convention from four days to two days and limit the addresses and committee reports strictly to those having a direct bearing on fuel performance.

Club Papers

Western Railway Club Elects Officers

Western Railway Club.—Forty-seventh annual meeting and dinner May 22. at the Hotel Sherman, Chicago, the Rev. Ernest F. Tittle, pastor of the First Methodist Church of Evanston, Ill., being the speaker of the evening.

Music for the dinner, which was attended by 400 members and guests, was furnished by a male chorus composed of Chicago & Alton employees. Officers elected for the ensuing year are as follows: President, C. T. Ripley, chief mechanical engineer of the Atchison, Topeka & Santa Fe, Chicago; first vice-president, O. E. Ward, superintendent of motive power of the Chicago, Burlington & Quincy, Chicago; second vice-president, C. M. House, superintendent of motive power and equipment of the Chicago & Alton, Bloomington, Ill.; and treasurer, J. W. Fogg, vice-president of the MacLean-Fogg Lock Nut Company, Chicago.

Chicago Subway Plans Discussed

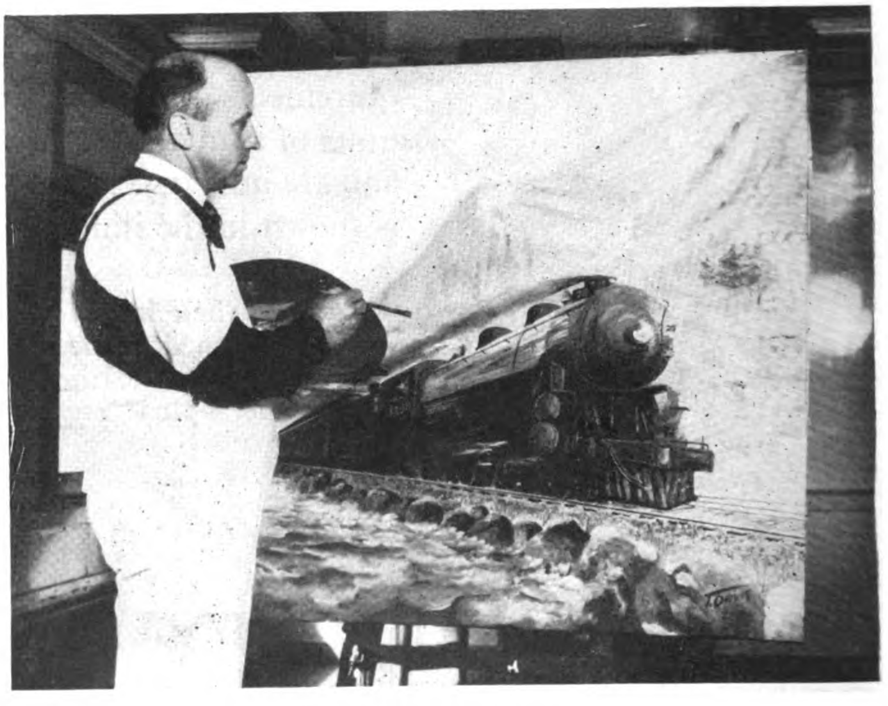
Western Railway Club.—Meeting, held at the Hotel Sherman, Chicago, Monday evening, April 20, devoted to a consideration of rapidly maturing plans for the new Chicago subway. ¶ A. J. Schafmayer, chief engineer of the Board of Local Improvements, Chicago, presented some of the legal and financial aspects of the development. Alfred Brahdy, resident representative of Robert Ridgway, chief consulting engineer, discussed the design and construction of the subway structure, his remarks being illustrated with informative slides. Harold Otis, engineer of car construction, Chicago Rapid Transit Company, outlined some of the problems to be met in the design of rolling stock best adapted to the particular requirements of this subway installation. All three speakers indicated that the plans in their respective departments are practically completed and, pending favorable court action regarding one detail of the financing, construction work will begin immediately.

Chicago Car Foremen Talk Safety

Car Foremen's Association of Chicago.—Meeting held Monday evening, May 11, at the Great Northern Hotel, Chicago. Subject "Safety First." Address by D. G. Phillips, superintendent of safety, Wabash, Decatur, Ill.

Safe practices as affecting the car department were discussed in an intensely practical talk by Mr. Phillips, who urged the necessity of adopting every reasonable means to sustain interest in safe equipment and methods of work. He said that during the past year the Wabash car department has operated without the loss of a single life, arm, hand, foot or eye, a wonderful record compared to what used to be considered a good performance not so many years ago. Since the car department employs more men than almost any other single railroad department, safe practices in the rebuilding and maintenance of cars are especially important.

* * *



Wide World Photo

T. M. Davis of San Bruno, Cal., is a painter of locomotives by day in the shops of the Southern Pacific and in his odd hours he paints locomotives on canvas. His paintings adorn the wall of the company's headquarters in San Francisco. Davis calls it his hobby and he has no thought of recompense. He is shown here with one of his paintings

Mr. Phillips asked the car men in attendance at the meeting the following three pertinent questions: "Have you issued necessary instructions for safe operation in the car department? Do you know that these instructions are being carried out? What steps are you taking to see that they are carried out?"

The Business Outlook

Cleveland Railway Club.—Meeting held on April 13 at the Brotherhood of Railroad Trainmen's Auditorium, West Ninth street and Superior avenue, Cleveland, Ohio. Paper by Col. F. W. Green, vice-president, St. Louis-Southwestern on, "The Business Outlook." ¶Col. Green outlined the conditions, caused by the present depression, which must be squarely faced by the railroads if they are to continue giving satisfactory service and earn a reasonable return on their investment. ¶Col. Green's address concluded with the following pertinent remarks. "Railroads work on a very narrow margin between income and outgo. Believe it or not, the welfare of the public is intimately related to the welfare of the railroads. It has been shown that over a long period of years, the curve of general prosperity and the curve of railroad prosperity run parallel. When railroads stop buying, prosperity wanes, and conversely. The reason for this is that the railroads rank at or near the top as consumers of bituminous coal, fuel oil, iron and steel, brass castings, lumber, cement, paints and varnishes, and so on. Prices fluctuate with demand. When the railroad demand stops, prices slump. If you want to help yourself, help the railroads, and if you want to help the railroads to do their part about bringing about a return of prosperity, may I suggest that you do two things: (1) Decline to permit yourself to be misled by fantastic economic theories, such as increasing wages to increase purchasing power, and (2) That you let your congressmen and senators know that you are interested in their helping to bring about return of prosperity and that, in your opinion, a quick way of bringing it about would be to permit trans-continental carriers to compete with ocean carriers operating through the Panama Canal without reduction of rates to all intermediate points to the basis of the ocean terminal rates."

Supply Companies Forego Annual Exhibits

Allied Railway Supply Association.—Meeting held at the Hotel Sherman, Chicago, Monday, May 4. ¶Representatives of the railway equipment manufacturers and supply companies, which usually hold exhibitions in connection with the annual conventions of railroad mechanical department officers and supervisors, discussed the unusual situation presented by the fact that most of the associations have definitely cancelled their annual meetings for the present year, or arranged for brief business sessions with no exhibits. In order to work more effectively with the General Committee of the American Railway Association, Mechanical division, in its plans for simultaneous convention dates and a single exhibition open to all, when next these associations meet, a new organization was formed known as the Allied Railway Supply Association, which consists of a consolidation of the following associations: Railway Equipment Manufacturers' Association (formerly meeting with the Traveling Engineers' Association); Air Brake Appliance Association (formerly meeting with the Air Brake Association); Association of Railway Supply Men (formerly meeting with the International Railway General Foremen's Association); Boiler Makers' Supply Men's Association (formerly meeting with the Master Boiler Makers' Association); International Railway Supply Men's Association (formerly meeting with the International Railway Fuel Association); Master Blacksmiths' Supply Men's Association (formerly meeting with the International Railroad Master Blacksmiths' Association); Supply Men's Association (formerly meeting with the Car Department Officers' Association). ¶The following were elected officers of the Allied Railway Supply Association: President, Irving H. Jones, Irving H. Jones Company, Cleveland, Ohio; first vice-president, Louis B. Rhodes, Vapor Car Heating Company, Washington, D. C.; second vice-president, S. A. Witt, Detroit Lubricator Company, Chicago; third vice-president, J. W. Fogg, MacLean-Fogg Lock Nut Company, Chicago; fourth vice-president, C. F. Weil, American Brake Shoe & Foundry Company, Chicago; fifth vice-president, Arthur S. Lewis, Barco Manufacturing Company, Chicago; sixth vice-president, W. A. Champieux, Oxweld Railroad Service Company, Chicago; secretary, F. W. Venton, Crane Company, Chicago; treasurer, G. R. Voyce, A. M. Castle & Co., Chicago.

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

ALLIED RAILWAY SUPPLY ASSOCIATION.—F. W. Venton, Crane Company, Chicago.

AMERICAN RAILWAY ASSOCIATION.—DIVISION V.—MECHANICAL.—V. R. Hawthorne, 59 East Van Buren street, Chicago. Meeting June 23, 24 and 25, Congress Hotel, Chicago.

DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey street, New York.

DIVISION I. — SAFETY SECTION. — J. C. Caviston, 30 Vesey street, New York.

DIVISION VIII.—CAR SERVICE DIVISION.—C. A. Buch, Seventeenth and H streets, Washington, D. C.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.

RAILROAD DIVISION.—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York.

MACHINE SHOP PRACTICE DIVISION. — Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.

MATERIALS HANDLING DIVISION.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.

OIL AND GAS POWER DIVISION.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.

FUELS DIVISION.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa.

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

CAR DEPARTMENT OFFICERS ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 608 South Main street, Los Angeles, Cal. Meetings second Monday of each month except July, August and September, in the Pacific Electric Club building, Los Angeles, Cal.

CAR FOREMAN'S ASSOCIATION OF OMAHA, Council Bluffs and South Omaha Interchange.—Geo. Kriegler, car foreman, Chicago, Burlington & Quincy, Sixteenth avenue and Sixth streets, Council Bluffs, Iowa. Regular meetings, second Thursday of each month at Council Bluffs.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—F. G. Weigman, 720 North Twenty-third street, East St. Louis, Ill. Regular meeting first Tuesday in each month, except July and August, at American Hotel Annex, St. Louis, Mo.

CLEVELAND RAILWAY CLUB.—F. L. Frericks, 14416 Adler avenue, Cleveland, Ohio. Meeting second Monday each month, except July, August and September, at the Auditorium, Brotherhood of Railroad Trainmen's building, West Ninth and Superior avenue, Cleveland.

INDIANAPOLIS CAR INSPECTION ASSOCIATION.—E. A. Jackson, Box 22, Mail Room, Union Station, Indianapolis, Ind. Regular meetings first Monday of each month at Hotel Severin, Indianapolis, at 7 p.m. Noon-day luncheon 12:15 p.m. for Executive Committee and men interested in the car department.

INTERNATIONAL RAILROAD MASTER BLACKSMITH'S ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago. Business session, without exhibit or entertainment, September 15 and 16, Hotel Sherman, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash street, Winona, Minn.

LOUISIANA CAR DEPARTMENT ASSOCIATION.—L. Brownlee, 3730 South Prieur street, New Orleans, La. Meetings third Thursday.

MASTER BOILERMAKER'S ASSOCIATION. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

MASTER CAR BUILDERS' AND SUPERVISORS' ASSOCIATION.—See Car Department Officers Association.

NATIONAL SAFETY COUNCIL—STEAM RAILROAD SECTION.—W. A. Booth, Canadian National Montreal, Que. William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

PACIFIC RAILWAY CLUB.—W. S. Wollner, P. O. Box, 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

PUEBLO CAR MEN'S ASSOCIATION.—I. F. Wharton, chief clerk, Interchange Bureau, Pueblo, Colo.

RAILWAY BUSINESS ASSOCIATION — Frank W. Noxon, 1124 Woodward building, Washington, D. C.

RAILWAY CAR MEN'S CLUB OF PEORIA AND PEKIN.—C. L. Roberts, chief clerk, Peoria & Pekin Union Railway, 217 Lydia avenue, Peoria, Ill.

RAILWAY FIRE PROTECTION ASSOCIATION.—R. R. Hackett, Baltimore & Ohio, Baltimore, Md.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, June, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

SUPPLY MEN'S ASSOCIATION. — E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division American Railway Association.

TRAVELING ENGINEERS' ASSOCIATION. — W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio.

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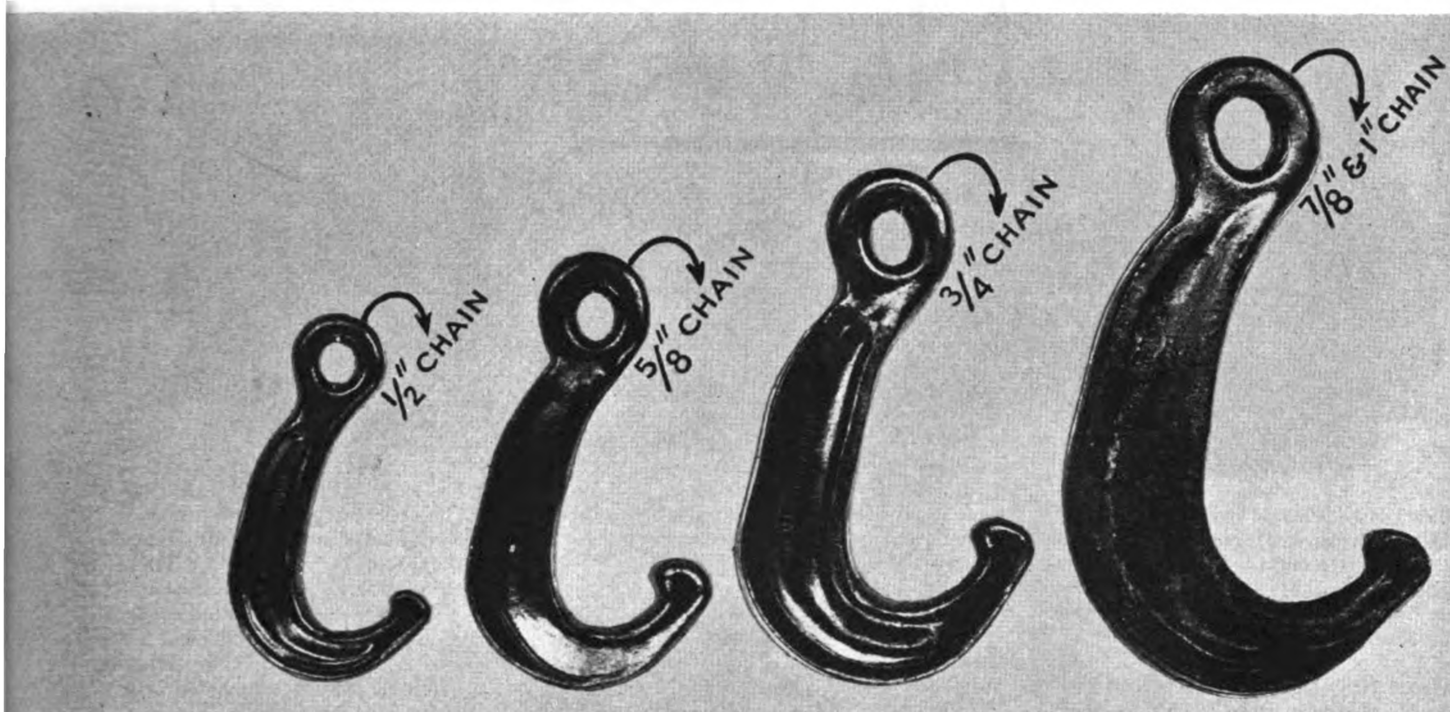


HOOK NO.	0	1	2	3
RATED LOAD	4000#	6000#	9000#	14000#
LOAD WITHOUT PERMANENT SET	8000#	11000#	16000#	24000#
FINAL TEST LOAD	20500#	35000#	48000#	76000#

A SAFETY HOOK

THE BEMIS HOOK, by reason of its unique design and great strength, stands between security and danger, between long life and early breakdown. It adds safety to every hooking and unhooking operation, protecting men and equipment.

The "barb" at the point of the Bemis Hook prevents accidental unhooking. It aids in hooking on to the load and stays hooked while slack is being taken up. A convenient depression in each side gives the crane-follower a secure hold without endangering the fingers to be caught by the load. It is not easy to carry loads on the point of the Bemis Hook—any opening into which the point will go will permit the load to fall down to the lower part of the hook assuring a firm and safe hold.

The above illustration shows how Bemis Hooks, tested to over 5 times their rated load, showed no signs of breaking and though stretched badly were not deformed enough to drop their load. Ordinary hooks with the sharp point, when distorted to this degree, would have dropped their load.

Bemis Hooks, drop forged from soft steel, will stand up in heavy service, and when heavily overloaded, open up instead of breaking.

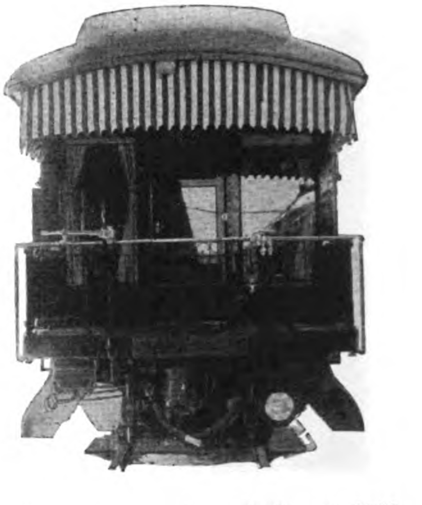
To meet the demand for a swivel type hook—the Bemis Hook is made with a straight shank for use on cranes and hoists requiring swivel hooks.

Bemis Hooks have been in service in some of the largest shops and have met with satisfaction every requirement of economy and safety.

MOTIVE COMPANY

NEW YORK CITY

NEWS



THE UNION PACIFIC has awarded a contract to Fairbanks, Morse & Co., Chicago, for the construction of a 450-ton steel locomotive coaling and sanding station, with full automatic skip hoist, at Marysville, Kan.

Alton Recalls 1,100 Mechanical and Maintenance Employees

APPROXIMATELY 1,100 mechanical, maintenance of way and signal department employees of the Chicago & Alton who have been laid off for varying periods have been recalled. About 800 maintenance of way workers resumed work on May 25, and next Monday, 250 shop employees and 50 signal department men will return to work. At the same time shop work will be changed from three-days-a-week to a five-day week basis.

Permanent Transport Exhibition in New York Museum

A PERMANENT EXHIBITION of the development of land and sea transportation comprising exact scale models of ships, trains, wagons, automobiles and other conveyances, together with historic originals and replicas, was opened on May 25 at the Museum of Science and Industry, 220 East Forty-second street, New York City, by Frederic B. Pratt, president of the museum.

The exhibition contains three divisions, devoted to displays of highway, railroad and marine travel respectively. It is a part of a projected series of exhibits which will ultimately portray the significant historical steps in the major fields of man's material evolution. The transportation exhibits were gathered and arranged under the direction of Professor Charles R. Richards, educator and authority on industrial museums, assisted by Carlos de Zafra, of the engineering faculty, New York University; Charles E. Duryea, co-inventor of the Duryea automobile; and Henry O. Havemeyer, Jr.

The history of railroad transportation is presented in a series of chronologically arranged models. Beginning with a model of the "Rocket," the world's first successful locomotive, and the "Tom Thumb," the first locomotive to be built in America, the display includes miniatures of the "Stourbridge Lion," one of the first locomotives used in this country, the "William Crooks," a typical representative of the design introduced in the United States in 1837 and used for the next 55 years, the "Wooten Boiler" locomotive of 1880 whose large grate area, burning fine-sized anthracite centered the attention of the railroad world on boiler development, through to the first electric locomotive of 1895 to be used in trunk line service, a model of the first Mallet type locomotive to be built in this country, a representative of the heaviest type of modern freight locomotives and the latest high pressure multiple expansion locomotive of today which shows a mechanical efficiency of 90.7 per cent.

A feature of the railroad division is an actual size replica of Stevenson's "Rocket," with sections of the working parts cut away to reveal its principles of operation. This replica, complete in details and made by the locomotive company which built the original more than one hundred years ago, is fifteen feet high, seven and one-half feet in length, and weighs approximately 7,000 pounds. It is accompanied by a tender, four feet long, supporting a wooden water barrel.

A series of models is also displayed which show passenger car development, while freight transportation is represented in models of ventilated refrigerator cars, auto freight cars, coal cars, mail cars and others. Included in the railroad division are displays showing the development of the railroad track, railroad signals and roadbed construction. There are also three visitor-operated models of the most important types of locomotive valves and reversing gears, detailing the basis of their working and construction.

P. R. R. Places $16,000,000 Order for Electric Locomotive Apparatus

THE PENNSYLVANIA has placed orders with the Westinghouse Electric & Manufacturing Company and the General Electric Company at an approximate cost of $16,000,000, for the electrical apparatus to be installed in 150 electric passenger and freight locomotives, constituting part of the equipment which will be used when electrification is completed between New York, Philadelphia, Baltimore and Washington.

The Pennsylvania's program also calls for the later purchase of 80 additional electric locomotives of other types. Of the 150 locomotives involved in the present orders, 90 will be for fast through passenger trains and 60 for high speed freight service. The weight of the passenger locomotives will be 375,000 lb. each, and that of the freight locomotives 330,000 lb.

Forthy-three of the new locomotives are to be delivered this year and the remainder before the middle of 1933, when it is anticipated that the electrification work between New York and Washington will be completed. There are now in use on the Pennsylvania System 61 electric locomotives and under construction 96 locomotives which will be increased to 326 by those now authorized and those contemplated for later purchase.

An Air-Conditioned Train

ANTICIPATING the approach of hot weather, a train entirely air-cooled and air-purified has been placed in service on the Baltimore & Ohio for the first time on any railway. The train so air-conditioned is the "Columbian," running between New York, Philadelphia, Baltimore and Washington. All of its equipment, consisting of a smoking lounge car, observation sun-room car, latest type parlor cars, individual seat coaches, and colonial dining car, is equipped with the air-purifying system, both north and south bound.

The apparatus not only regulates the temperature of the air but also controls the humidity and purifies the air, cleansing it of all particles of dust, cinders and smoke. The air is circulated without creating drafts.

The regulation of the temperature is automatically controlled by a thermostat and the apparatus functions both while the train is running and when it is standing still.

Years of experimental work by the mechanical engineers of the Baltimore & Ohio and the Mt. Clare shop forces at Baltimore were required to bring the air-conditioning system into practical use. It was first introduced on the Baltimore & Ohio in a limited way last summer when the railroad successfully air-conditioned one of its diners.

Louisiana & Arkansas Wages

THE EMERGENCY BOARD appointed by President Hoover to deal with the controversy between the Louisiana & Arkansas and its mechanical department employees, which threatened to develop into a strike on April 18, held hearings at Shreveport, La., from April 24 to May 1, and Judge Charles Kerr, chairman of the board who transmitted a report of the

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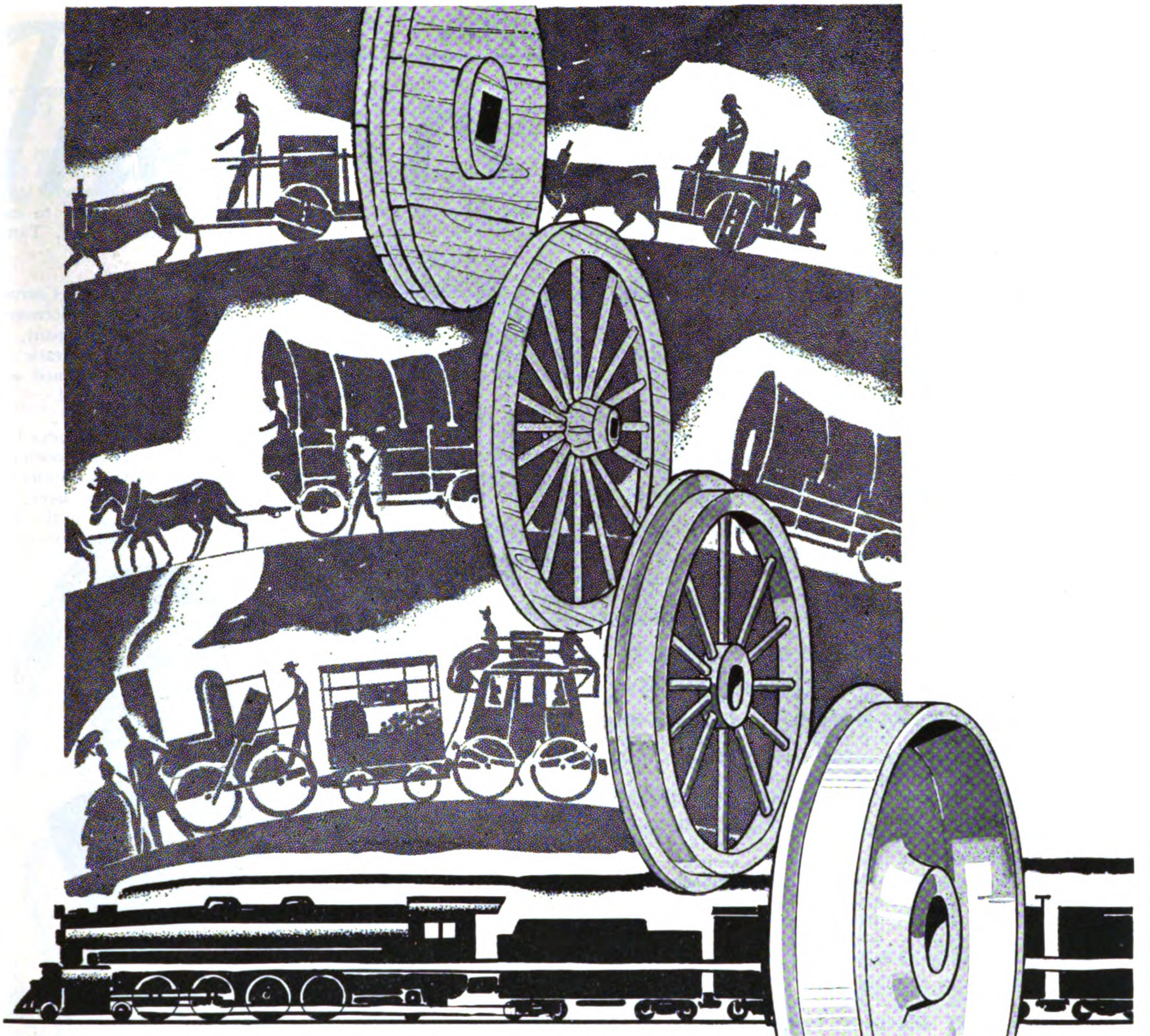

THE WORLD MOVES on WHEELS

FROM the time man discovered that a rounded object rolls with comparative ease and devised the first crude cart, he has ever been on the move. His means of conveyance have undergone vast changes. The slow joggle of the oxcart has given place to the swift flight of the express train, but never has the wheel been supplanted as the basic factor of transportation. Instead, it has become more vitally important than ever. The speed and weight of modern transportation throw a tremendous responsibility on wheels. Significant then is the fact that Carnegie Wrought Steel Wheels are considered the standard of excellence in today's exacting service. To serve even more efficiently, we are now prepared to furnish Rim-Toughened Wrought Steel Wheels. The process of heat treatment to which these wheels are subjected insures additional service out of all proportion to the small increase in cost. Our wheel engineers will be glad to discuss this matter with you further.

CARNEGIE WROUGHT STEEL WHEELS

Product of Carnegie Steel Company, Pittsburgh, Pa. US STEEL *Subsidiary of United States Steel Corporation*

controversy to the President on May 16. Contrary to the usual practice in such cases, it was not made public. Instead, it was announced at the White House that the management of the road had been asked to come to Washington for further conference with the Board of Mediation in an effort to bring about an adjustment. The law provides that for 30 days after such a board has made its report no change, except by agreement, shall be made by the parties to the controversy in the conditions of the dispute.

The railroad on February 9 ordered a new wage scale and altered working rules for its shop craftsmen, A. L. Burford, of Wilkinson, Lewis, Wilkinson & Burford, general counsel for the L. & A., stated at the opening session of the hearing. The new wage scale of 75 cents an hour represented a reduction of 5 cents an hour. It is the same rate paid prior to August 1, 1929, and 5 cents an hour more than was paid to shop craftsmen on the Louisiana Railway & Navigation Co. before it was purchased by the L. & A. in 1929. Consolidation of the two railroads resulted on August 1, 1929, in a base scale of 80 cents an hour, representing a 10-cent increase for L. R. & N. employees and a 5-cent increase for L. & A. employees.

Adverse business conditions in 1930 led the railroad to suggest a wage cut of 5 cents an hour and a revision of working rules. Other employees of the L. & A., including all officers, have been subjected to a 12½ per cent reduction in salaries. The wage cuts were made necessary by the 1930 business depression, depletion of standing timber in the area served by the railroad, loss of oil tonnage due to competition of pipe lines, and curtailment of other revenues through motor coach and truck competition and crop shortages.

C. P. Couch, executive vice-president of the L. & A., estimated that the wage cut would result in a monthly saving to the railroad of $2,000. H. J. Carr, general vice-president of the Machinists' Union, charged that the revised working rules tend to "break down the apprentice system, give inexperienced men equal pay with experienced men and deny the right of representation of the workmen's choosing." He said that the new rules denied seniority to those who left railroad service to engage in union work.

Supply Trade Notes

THE ROYAL RAILWAY SUPPLY COMPANY, INC., has moved its office from 90 West street to 250 Park avenue, New York.

C. E. NAYLOR, manufacturers' agent, specializing in railway and refinery supplies, has moved his office from the Esperson building to 1400 Conti street, Houston, Tex.

WILLIAM L. HARTLEY has been appointed district sales manager with headquarters at 5938 Linsdale avenue, Detroit, Mich., in charge of Detroit territory for the Link-Belt Company, Chicago.

J. H. MORRIS, assistant secretary and assistant treasurer of the Inland Steel Company, has been promoted to secretary. W. D. Truesdale, secretary and treasurer, will continue as treasurer.

THE PYLE-NATIONAL COMPANY'S office now located in Washington, D. C., has been transferred to the Baltimore Trust building, Baltimore, Md. J. L. Reese will be in charge.

A. J. COUSE has been appointed district manager of the Chicago territory for the Edgewater Steel Company, Pittsburgh, Pa. Mr. Couse will have his headquarters as heretofore, in the Peoples Gas building, Chicago.

J. L. VAUCLAIN, vice-president and manager of the Baldwin Locomotive Works, Eddystone, Pa., has resigned on account of ill health. He is a son of Samuel M. Vauclain, chairman of the board of directors.

J. C. MCQUISTON, general advertising manager of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has retired. Mr. McQuiston had been in charge of advertising for the Westinghouse company for 29 years.

M. B. MACNEILLE, manager of the pump division of Fairbanks, Morse & Company, has resigned after 19 years connection with that company, to join the sales organization of the Dayton-Dowd Company, Quincy, Ill. Mr. MacNeille will act as western sales manager with headquarters at San Francisco, Cal.

ALVAH H. WARREN, JR., assistant manager of sales of the Illinois Steel Company, Chicago, with headquarters at St. Paul, Minn., has been promoted to manager of sales to succeed W. J. Totten, retired.

THE DARDELET THREADLOCK CORPORATION, New York, has granted licenses to the Colorado Fuel & Iron Company, for the manufacture and sale of track and commercial bolts and nuts formed with the Dardelet self-locking thread.

THE SUPERIOR RAILWAY PRODUCTS CORPORATION, a newly organized company, with offices at 7501 Thomas Boulevard, Pittsburgh, Pa., has taken over the manufacture and marketing of the railway products formerly manufactured by

W. R. Gellatly

the Rees Manufacturing Company, Pittsburgh. William R. Gellatly, formerly vice-president of the Rees Manufacturing Company, is president of the new organization.

R. F. MEHL, superintendent of the division of physical metallurgy of the Naval Research Laboratory has been appointed assistant director of research of the American Rolling Mill Company, Middletown, Ohio. He will take charge on September 1 of the physical science department of the Armco laboratories.

J. E. BUCKINGHAM has been appointed western regional manager of the railroad division of the Worthington Pump & Machinery Corporation, with headquarters at Chicago, succeeding J. M. Lammedee, resigned. Mr. Buckingham was formerly located at Harrison, N. J.

THE GRINDLE FUEL EQUIPMENT COMPANY, Harvey, Ill, a subsidiary of the Whiting Corporation, has purchased the exclusive manufacturing and selling rights to the Bethlehem pulverizer formerly manufactured by the Bethlehem Steel Company.

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Domestic Orders Reported During May, 1931

Locomotives

Name of Company	Number ordered	Type	Builder
Lehigh & New England	1	Switching	Baldwin Locomotive Wks.
Pennsylvania	150	Electric	Westinghouse Elec. & Manufacturing Co. and General Electric Co.
Total for Month of May	151		

Freight Cars

Name of Company	Number ordered	Type	Builder
Union Tank Car Company	15	Tank	American Car & Foundry Company
Erie	1	Dump	Koppel Industrial Car & Equipment Co.
Chicago, Milwaukee, St. Paul & Pacific	4	Dump	Western Wheeled Scraper Company
Union Pacific	6	Dump	Differential Steel Car Company.
United Verde Copper Company	4	Dump	Western Wheeled Scraper Company
Board of Transportation, City of New York	16	Service	Magor Car Corporation
Total for Month of May	46		

H. T. Bennett, assistant manager of sales of the American Sheet & Tin Plate Company, Pittsburgh, Pa., with headquarters at Chicago, has been promoted to manager of sales, with the same headquarters, to succeed W. H. Eaton, who retired on May 1, and has been succeeded by A. P. Bronson, representative at Chicago.

William Thompson, assistant to the president of the American Steel & Wire Company, Cleveland, Ohio, retired on May 1. George F. Rummel, for the past two years assigned to special work and during the previous 26 years assistant general manager of sales, also retired.

J. E. Gardiner, formerly general air brake inspector of the Boston & Maine and since July, 1930, a sales representative of the Gustin-Bacon Manufacturing Company at Philadelphia, Pa., has been appointed special representative of the Schaefer Equipment Company, with headquarters at Pittsburgh, Pa. Mr. Gardiner has been an active member of the Air Brake Association for many years and was for a time a member of its executive committee.

J. E. Gardiner

At a recent meeting of the board of directors of the General Refractories Company, Philadelphia, Pa., Burrows Sloan was elected chairman of the board, John R. Sproul was elected president, E. A. McKelvy was elected vice-president and Roger A. Hitchins was elected secretary and treasurer. All of the other officers of the company were reappointed. In addition to being president and a director of the General Refractories Company, John R. Sproul is a director of the Lehigh Valley, the Philadelphia, Baltimore & Washington and vice-president and director of the Lackawanna & Wyoming Valley.

J R. Crocker, for a number of years district manager of the Permutit Company, New York, who has been associated with the company since 1913, has been appointed special western railroad representative, with headquarters at 215 Pershing Road, Kansas City, Mo., and W. R. Toppan has been appointed special eastern railroad representative, with office at 332 South Michigan avenue, Chicago.

Fansteel Products Company, Inc., North Chicago, Ill., has organized a subsidiary, the Ramet Corporation of America, to take over the United States and Canadian rights for hard cutting metals developed by the former company. The officers of the new company are: President, J. M. Troxel, chairman of the board of Fansteel; vice-president and general manager, C. E. Stryker, manager of Balkite sales of Fansteel; and secretary and treasurer, E. F. Radke, secretary and treasurer of Fansteel.

John Thomas, general sales manager of the McIntosh & Seymour Corporation, Auburn, N. Y., has been appointed vice-president in charge of sales, with the same headquarters. Mr. Thomas was born in Alabama and is a graduate engineer. He served for ten years with the General Electric Company during the latter part of which he was in charge of the marine section. Mr. Thomas was appointed general sales manager of the McIntosh & Seymour Corporation in October, 1930.

John Thomas

J. K. Aimer has been appointed assistant general manager of sales of the Reading Iron Company, with office at 230 Park avenue, New York. W. S. Shiffer has been appointed assistant to general manager of sales, and R. I. Fretz has been transferred from the Reading district and is in charge as district sales representative of the Pittsburgh district in place of Wyman Howells, who now directs the activities of the Reading district; Harry L. Bialock is associated with the St. Louis district under the direction of J. L. Jacobson, district sales representative; L. C. Hartzell, under the direction of R. W. Thompson, Reading, Pa., is engaged in the promotion of the nipple business; George D. Smith, has been appointed railroad salesman under the direction of Mr. Aimer, and E. S. Moorehead has been assigned to the Pittsburgh district under the direction of Mr. Fretz.

J. S. Tritle, vice-president in charge of manufacturing of the Westinghouse Electric & Manufacturing Company, has been elected vice-president and general manager in charge of manufacturing, sales and engineering operations of the company, reporting to President F. A. Merrick, with headquarters as heretofore at East Pittsburgh, Pa. Mr. Tritle was born at Virginia City, Nev., in 1872 and was graduated from Yale University in 1893 with a degree in science. In 1895 he entered the electrical engineering contracting business, in which he continued for eight years. At the outset of the St. Louis World's Fair, he served as chief of construction and at the close of the fair, he was made manager of the Kansas City district for the Westinghouse Company. In 1915 the St. Louis and Kansas City offices were consolidated and Mr. Tritle assumed charge of both. In 1922 he was made manager of the merchandising department, a division of the general sales department of the company. In 1925, when a separate department was made of the merchandising business, Mr. Tritle was made general manager of the merchandising department, with headquarters at Mansfield, Ohio, overseeing engineering and manufacturing as well as sales work of that department. On May 1, 1929, he was appointed vice-president in charge of manufacturing operations, with headquarters at East Pittsburgh.

J. S. Tritle

John M. Lessels, formerly manager of the mechanics division of the Westinghouse research laboratories, has been appointed manager of engineering at the South Philadelphia works of the Westinghouse Electric & Manufacturing Company. Mr. Lessels was born at Dunfermline, Scotland, in 1888. He attended Heriot-Watt College, Edinburgh, the University of Edinburgh and the University of Glasgow, graduating from the latter institution in 1915 with the degree of bachelor of science in engineering, both mechanical and electrical. He was Lauder-Carnegie scholar at Glasgow in 1911. He later held positions as aero-engine inspector for the British war office, as assistant manager of the aero-engine department of Armstrong-Whitworth, Newcastle-on-Tyne, and as special engineer to works manager in charge of all sub-contractors for Rolls Royce. He entered the Westinghouse organization in February, 1920, and served six months in the office of the chief mechanical engineer. He then was appointed mechanical engineer in the railway department, which position he left in May, 1922, to

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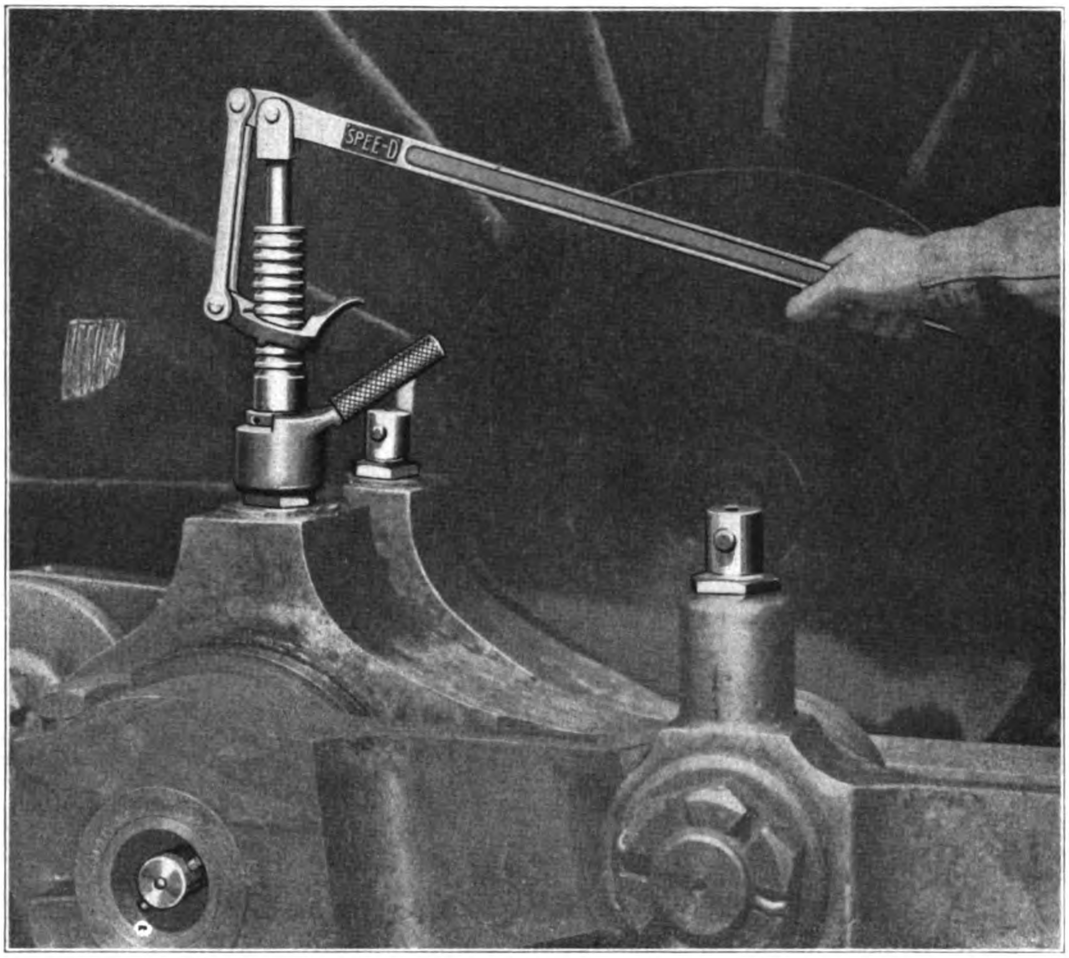

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enter the research department. He is an active member of several engineering societies and technical organizations in this country and aboard, and is secretary

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J. M. Lessells

of the executive committee of the Applied Mechanics Division of the American Society of Mechanical Engineers.

Baldwin Acquires Cramp-Morris Properties

The Baldwin Locomotive Works has purchased the subsidiaries of Cramp-Morris Industrial, Inc., which include I. P. Morris & De La Vergne, Inc.; De La Vergne Engine Company; Cramp Brass & Iron Foundries Company, all of Philadelphia, Pa.; the Federal Steel Foundry Company of Chester, Pa., and the Pelton Water Wheel Company of San Francisco, Cal.

While plans for the disposition of the newly acquired properties have not yet been completed, a gradual absorption is contemplated and, where practicable, it is anticipated that machinery and assets will be removed to the Eddystone, Pa., plant, from which point all activities in the future will be directed.

With the transfer of its subsidiaries to Baldwin, the Cramp-Morris Company has divested itself of its major assets. The old William Cramp & Sons shipyard is not included in the deal and that property will continue in the process of liquidation. Prior to 1927 the companies just acquired by Baldwin were either subsidiaries or non-marine departments of the William Cramp & Sons Ship & Engine Building Company. In 1926 when the latter company decided to discontinue the building of ships, the subsidiaries and departments were placed under a holding company, Cramp-Morris Industrials, Inc.

H. Birchard Taylor, president of the Cramp-Morris Properties, is expected to join the Baldwin group, and policies of conducting research and experimental work followed in the development of Cramp-Morris products will be carried on with increased facilities under Baldwin management.

I. P. Morris & De La Vergne, Inc., manufacturers of hydraulic turbine machinery, represents a consolidation of the I. P. Morris Company and the De La Vergne Machine Company, formerly of New York, but recently moved to Philadelphia and consolidated with the operations of the I. P. Morris Company. The De La Vergne Machine Company for many years designed and constructed refrigerating machinery and was one of the first concerns in the United States to develop Diesel engines. The Pelton Water Wheel Company designs and constructs hydraulic turbine machinery and valves; the Federal Steel Foundry Company specializes in high-grade commercial steel castings, and the Cramp Brass & Iron Foundries Company operates a cupola iron foundry, an electric iron foundry and one of the largest brass foundries in the United States.

Obituary

Harrington Emerson, consulting engineer, writer and educator, died at New York on May 23 at the age of 77. Mr. Emerson was born at Trenton, N. J., on August 2, 1853. He attended the Royal Bavarian Polytechnic in Germany from 1872 to 1875 and during the year 1875-76 attended universities in Italy and Greece. From 1876 to 1882 he was professor of modern languages at the University of Nebraska, and for the next four years was engaged in banking and land business. From 1896 to 1898 he examined many industrial plants and mines in the United States, Mexico and Canada as a United States representative of a British syndicate. From 1900 to 1923 he was president of Emerson Engi-

Harrington Emerson

neers, efficiency engineers, and during the years 1898-1901 he put into operation some of the first long distance mail routes in Alaska and down the Yukon. He reported on all the known coal deposits of the North American western coast and also on the northern submarine cable route to Asia, the latter report being largely followed by the War Department in laying its Alaskan cables. He gained recognition through results obtained by efficiency methods installed on the Atchison, Topeka & Santa Fe and was the author of "Efficiency as the Basis for Operation and Wages," published in 1909; "The Twelve Principles of Efficiency"; "Colonel Schoonmaker and the Pittsburgh & Lake Erie Railroad," and "Lessons in Personal Efficiency." In 1921 Mr. Emerson was appointed a member of the Committee for Elimination of Waste in Industry of the Federated American Engineering Societies, the committee, headed by Herbert Hoover, having been assigned to investigate and report on railroads and bituminous coal mining. He was a member of the American Society of Mechanical Engineers; Societe des Ingenieurs Civils de France (president American Section); Mechanical and Purchases and Stores Divisions, A. R. A.; American Economic Association; American Association of Labor Legislation; American Electrochemical Society; American Institute of Metals; Illuminating Engineering Society; American Electric Railway Association; Franklin Institute, etc.

Wilson E. Symons, consulting engineer, died on May 1 at the Elks Club, New York City, where he had resided for some time. Mr. Symons was born on December 18, 1858, at Farmland, Ind., and was educated at Dublin Academy in eastern Indiana. He began railway work in 1880 as a machinist at the Chicago shops of the Chicago, Rock Island & Pacific. From 1881 to 1885 he was chief engineer in the merchant marine service on the Great Lakes and then to 1887 was consecutively locomotive fireman and engineman, and engaged in special engineering work on the Wisconsin Central. He subsequently served as locomotive engineman on the Atlantic & Pacific, now part of the Atchison, Topeka & Santa Fe, and in special engineering work in California and Arizona until 1889 when he went to the Electric Engineering Works, Chicago. The following year he was appointed general foreman of the Atchison, Topeka & Santa Fe, at Chanute, Kan., subsequently serving as master mechanic on the same road first at Arkansas City, Kan., then at Raton, N. M., and later on the Mexican Central, at San Luis Potosi, Mex. From 1896 to 1898 he was mechanical expert and salesman of the Galina Oil Company, in the United States, England and France. He then was appointed superintendent of motive power and equipment at Savannah, Ga., on the Plant System, now a part of the Atlantic Coast Line, and from May, 1902, until August, 1904, was mechanical superintendent of the Gulf, Colorado & Santa Fe. From August, 1904, until the following June, he was with the Kansas City Southern as superintendent of machinery and later was engaged in special consulting work at Chicago. In 1909 he was appointed superintendent of motive power and machinery of the Chicago Great Western, at St. Paul, Minn., returning to special railway consulting work in 1910 at Chicago. He served from December, 1912, for about eight months as superintendent of motive power of the San Antonio & Aransas Pass. From 1914 to 1919 Mr. Symons was a vice-president of the Wilson Welder & Metals Company, New York, and since that time had been engaged as an editorial writer and a consulting engineer, specializing in railway engineering work.

(Continued on next left-hand page)

Personal Mention

General

The title of Hugh Ronalds, master mechanic of the Lehigh & New England, with headquarters at Pen Argyl, Pa., has been changed to superintendent of motive power.

H. W. Reinhardt, assistant superintendent of motive power of the Chicago Great Western, has been promoted to superintendent of motive power, with headquarters as before at Oelwein, Iowa, succeeding E. J. Brennan, who retired from active service on May 1.

John Horrigan, who retired on May 1 as superintendent of motive power of the Elgin, Joliet & Eastern, with headquarters at Joliet, Ill., has been connected with that railroad for more than 36 years, 32 of which were as superintendent of motive power. He was born at Mendota, Ill., on June 23, 1860, and attended the public schools at Marshalltown, Iowa. He entered railroad service in 1877 as a machinist apprentice on the Iowa Central (now part of the Minneapolis & St. Louis). Later he was advanced successively through the positions of machinist, enginehouse foreman

J. Horrigan

and division master mechanic at Keithsburg, Ill. On May 1, 1893, Mr. Horrigan became enginehouse foreman of the Chicago, Rock Island & Pacific at Blue Island, Ill., and in the following year he was appointed master mechanic on the Elgin, Joliet & Eastern at Joliet. He was promoted to superintendent of motive power on May 15, 1899, in which position he remained continuously until his retirement.

W. D. Robb, vice-president of the Canadian National in charge of telegraphs, colonization, natural resources, radio, insurance, etc., will retire on June 30, after the completion of 60 years of active service. Upon his retirement the vice-presidency occupied by Mr. Robb will be abolished, and the various departments of which he has charge will be allocated to the jurisdiction of other officers in the National System. Mr. Robb was born on September 23, 1857, at Longueuil, Que., and was educated at Sherbrooke Academy, Sherbrooke, Que., and Richmond College, Richmond, Que. He began his railroad career in July, 1871, as an apprentice in the motive power department of the Grand Trunk (now part of the C. N. R.), and in May, 1874, was transferred to Montreal, completing his apprenticeship at that point. In February, 1883, he be-

W. D. Robb

came night locomotive foreman serving in that capacity first at Port St. Charles, and later at Belleville, Ont. In January, 1897, he was appointed master mechanic at London, Ont., and nine months later was assigned a similar position at Toronto, Ont. In 1901, Mr. Robb was appointed acting superintendent of motive power at Montreal, and in the following year became superintendent of motive power. In 1917, he was appointed vice-president in charge of the motive power and car departments; in 1918, became operating vice-president of the system; in 1922, vice-president and general manager, and, in February, 1923, was appointed to the position of vice-president.

Master Mechanics and Road Foremen

W. C. Davis has been appointed road foreman of engines of the Southern Pacific, Pacific Lines, with headquarters at Dunsmuir, Cal.

The Jurisdiction of F. P. Nash, master mechanic of the Burnside shops, has been extended to include the Chicago terminal.

D. W. Saunders, master mechanic of the Chicago terminal of the Illinois Central, has been transferred to Vicksburg, Miss., succeeding S. R. Mauldin.

The Jurisdiction of H. L. Needham, general master mechanic on the Illinois Central at Chicago, has been extended to include the Burnside shops at Chicago.

G. C. Hess, assistant road foreman of engines of the Cumberland Valley division of the Pennsylvania, has been promoted to the position of assistant road foreman of engines of the Middle division.

R. C. McIntyre has been appointed master mechanic of the Union Railroad, succeeding Charles R. Church, retired. Mr. McIntyre's headquarters will be at East Pittsburgh, Pa.

A. H. Hoffman, assistant general air brake inspector and district road foreman of engines of the Southern Pacific, with headquarters at Los Angeles, Cal., has been appointed road foreman of engines of the San Joaquin division, with headquarters at Bakersfield, Cal.

Car Department

D. J. Paskey, car foreman of the Central of New Jersey at Penobscot, Pa., has been appointed general car foreman, with headquarters at Allentown, Pa.

Shops and Enginehouse

W. E. Mullen has been appointed general foreman of the Pennsylvania, with headquarters at Northumberland, Pa.

S. R. Mauldin, master mechanic of the Illinois Central at Vicksburg, Miss., has been appointed general foreman, locomotive department, at Vicksburg.

W. U. Dixon, general foreman of the Delmarva division of the Pennsylvania, has been promoted to the position of assistant supervisor of the Williamsport division, with headquarters at Millersburg, Pa.

Purchasing and Stores

J. R. Ummel, office manager of the Alaska Railroad, with headquarters at Seattle, Wash., has been appointed also purchasing agent.

C. S. Jones, division storekeeper of Stockton division of the Southern Pacific at Tracy, Cal., has been transferred to the Shasta division at Dunsmuir, Cal.

C. J. Pearce, division storekeeper of the Shasta division of the Southern Pacific at Dunsmuir, Cal., has been transferred to the Western division, with headquarters at Oakland Pier, Cal.

H. J. Vance, purchasing agent of the Chicago & Illinois Valley, with headquarters at Granite City, Ill., has been appointed chief purchasing officer of the Illinois Terminal System, with headquarters at Chicago.

Obituary

C. V. Coulter, formerly district storekeeper of the Cleveland, Cincinnati, Chicago & St. Louis, died at his home in Indianapolis, Ind., May 12, after a short illness.

Leslie G. Pearson, district storekeeper on the Southern Pacific at El Paso, Tex., died in that city on May 7 from injuries received when he was struck by a broken emery wheel on a portable electric grinder.

Railway Mechanical Engineer

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Interesting new Milwaukee diner is equipped with Timken Bearings

Tapered Roller
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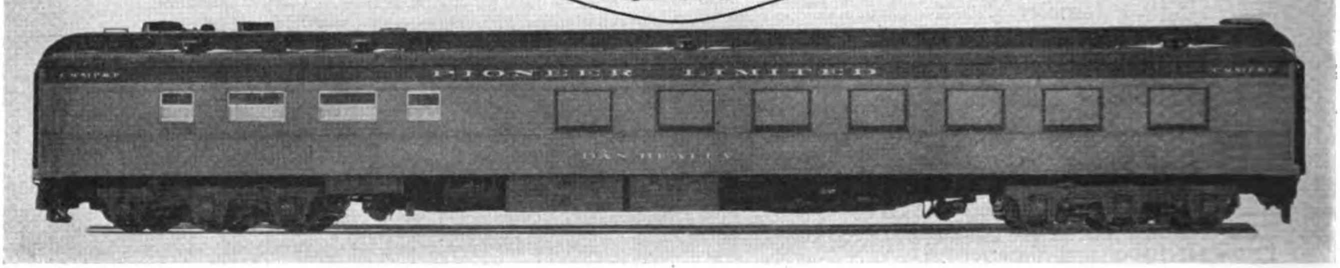

Perpetuating the name of Dan Healey, famed Milwaukee Road steward of days gone by, this new diner is also representative of a new standard of dining car luxury and comfort.

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Railway
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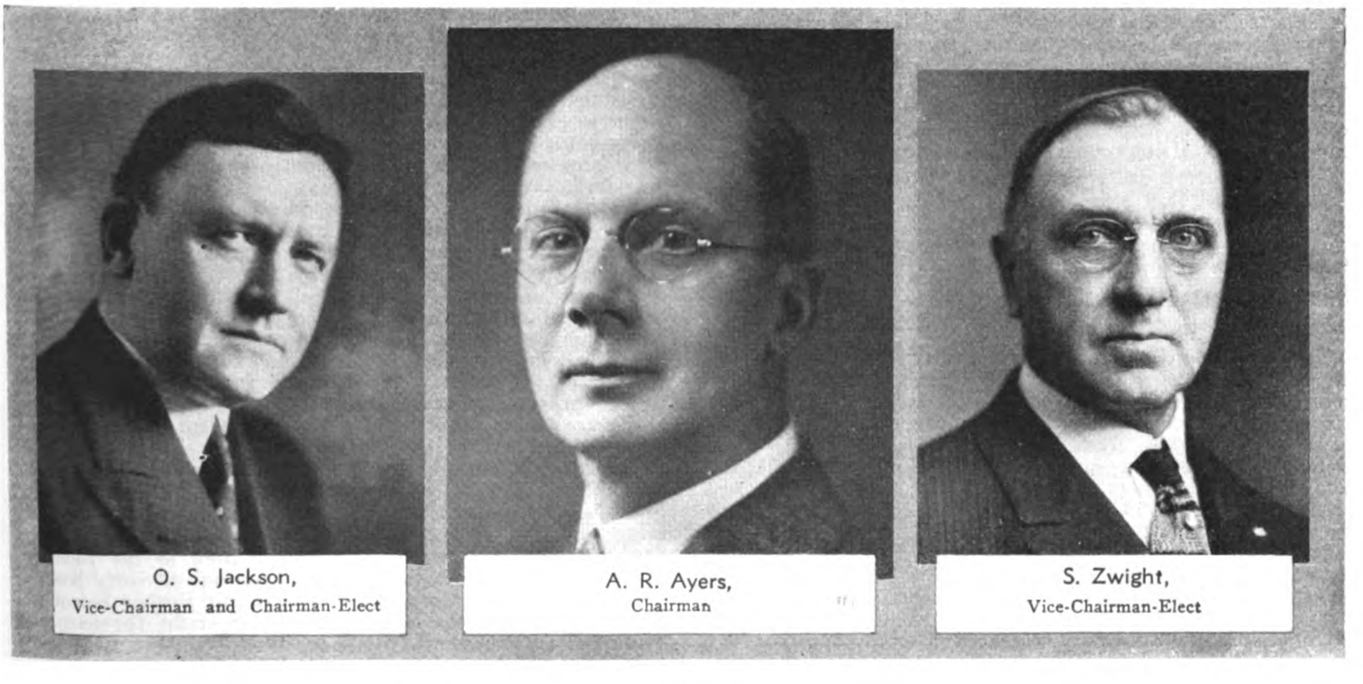
July - 1931

Twelfth Meeting of Mechanical Division Held at Chicago

Mechanical Division, A. R. A., holds two-day session beginning June 23—Principal addresses by R. H. Aishton, and M. J. Gormley — Total of 18 committee reports and one paper included in program — O. S. Jackson elected chairman

THE Mechanical Division, American Railway Association, held its twelfth annual meeting at the Congress Hotel, Chicago, June 23 and 24, 1931. In accordance with the program announced several months ago, all entertainment and exhibition features were eliminated and the meeting was confined strictly to a two-day business session. Following the opening exercises, Chairman A. R. Ayers, general manager, New York, Chicago & St. Louis, made a brief address and called for the report of the General Committee, which was read by Secretary V. R. Hawthorne. This report outlined the principal activities of the Mechanical Division during the past year and, among other items of special interest, stressed the important test work conducted under the auspices of the division, as follows: Road tests of power brakes, a report of which is now under preparation; coupler tests, as a result of which a swivel-butt coupler and yoke design are suggested for adoption as alternate standard with the Type-E coupler; draft gear tests, resulting in the recommendation that the specifications for approved draft gears submitted last year be adopted as standard except as regards the recoil feature which is subject to further



O. S. Jackson, Vice-Chairman and Chairman-Elect

A. R. Ayers, Chairman

S. Zwight, Vice-Chairman-Elect

study; laboratory tests of automatic hose connectors made at Purdue university under the direction of H. A. Johnson, director of research, American Railway Association.

Chairman Ayers introduced the first speaker at the opening session, R. H. Aishton, president of the American Railway Association, who was followed by M. J. Gormley, executive vice-president. Abstracts of the addresses and committee reports presented during the two-day session of the division are included below, with the exception of a brief report of the Committee on Utilization of Locomotives and Conservation of Fuel. This consisted of a summary comparison of operating statistics of 1929 and 1930.

Mr. Aishton's Address

After welcoming the members to the convention, R. H. Aishton, president of the American Railway Association, stated that, individually and collectively, they are now faced with difficult problems, but almost every other industry and class of men is now confronted with similar problems which are no more serious than have been met and overcome in the past. The keynote of Mr. Aishton's brief remarks was an appeal for railroad men to be receptive to new ideas and willing to violate all precedents, if necessary, in helping fit the railroads to meet new conditions successfully.

Mr. Aishton quoted at length from newspaper clippings which openly charged American railways with negligence in failing to develop light-weight equipment with operating speeds up to 150 m.p.h. as are reported obtainable with the Zeppelin air-propelled rail car recently developed in Germany. These clippings maintain that if American railroad engineers have not sufficient initiative to carry developments of this kind to a successful conclusion, they ought to call in European engineers to show them how. Mr. Aishton said that, while he does not necessarily advocate the type of equipment referred to, and practical railroad men in this country consider operating speeds of 150 m.p.h. "the stuff that dreams are made of," he does advocate that railroad men keep their eyes open to new developments which are going on everywhere about them. Past experience has shown that practically every vital improvement in railroad practice and operation in the past has been looked upon with skepticism and distrust at first.

Mr. Aishton paid a high tribute to the work of the Mechanical Division, as well as to the mechanical departments of the railroads in general, and said that they must bear the brunt of developments of those devices and methods which will enable the railroads to keep in the forefront of progress and meet new conditions as they arise. Quoting the familiar expression, "The horse makes the wagon go," he said that adequate motive power is essential in order that the railroads may continue to carry the transportation burden of the country.

Mr. Aishton closed his remarks with the statement that the board of directors of the American Railway Association is keenly desirous of helping the Mechanical Division in its vitally-important task of improving mechanical-department conditions.

Address by Mr. Gormley

The railroads, due to greatly-increased efficiency in operation, can continue to meet, without difficulty, for some time to come, but with fewer freight cars than they now own, the transportation requirements of this country based on any reasonable peak of traffic that might be expected, M. J. Gormley, executive vice-president, American Railway Association, told the members of the Mechanical Division.

"The railroads in 1923," said Mr. Gormley, in addressing the opening session, "adopted a program for the rehabilitation of the transportation machine after the war. Since the beginning of that year, the railroads have spent more than six and three-quarter billions of dollars for improvements in furtherance of that program.

"Since 1923, the railways have placed in service approximately 890,000 new cars and 15,000 new locomotives, but have retired so many that we now own 116,000 fewer cars, not including refrigerators, than at the high point of ownership in 1925, and have 9,000 fewer locomotives. This new and improved equipment, with more powerful locomotives and increased capacity of cars, has brought about an increase in efficiency in movement of cars in the past eight years of 26 per cent, based on the miles per car per day, not including surplus equipment. There has also been an increase of 26.6 per cent in the miles per train-hour during the same period.

"As a result of this efficiency and economy, the unit cost of railway operation has been decreasing annually. If the unit cost of operation had been the same in 1929 as it was in 1923, the total operating expenses of the carriers would have been greater than they were by $519,000,000. This would have meant a reduction of 41.5 per cent in the net income actually earned in 1929.

"We do not, however, get the full advantage of this increase in efficiency in movement unless it is paralleled with a reduction in the amount of capital invested in equipment.

"In view of the greatly-increased efficiency of movement, and based on any reasonable peak of traffic that might be expected, we now estimate that the traffic of the country for some time to come can be handled with a further decrease in freight cars, not including refrigerators, of 134,000, which would mean a total reduction of 250,000 under the ownership at its high point in 1925. This is a conservative estimate, and is not based on the depressed situation of today or of last year.

"In bringing about any reduction in car ownership, it should always be kept in mind that it can be accomplished successfully only by continuing the policy of replacement of the less efficient cars by a lesser number of modern cars and by a standard of maintenance that will reduce delays to loaded cars en route."

In discussing standards of maintenance, Mr. Gormley mentioned the considerable number of cars now going to repair tracks because of defective brake rigging, trucks, draft gears, arch bars, etc., and suggested that these parts receive proper attention wherever cars are on the repair tracks for periodic air-brake attention or heavy repairs. General maintenance conditions will thereby be greatly improved and delays to cars and lading correspondingly reduced.

After outlining present conditions with regard to the ownership of automobile equipment, Mr. Gormley said that future purchases of this equipment should generally be made by railroads directly serving the automobile-producing territory, a practice which will greatly decrease the total number of automobile cars required. This same condition applies with respect to other special equipment, such as cars for handling automobile bodies, automobile engines, gondola cars for handling long steel shapes, pipes, etc.

Sufficient Special-Type Cars to Move Traffic

With regard to privately-owned freight cars, Mr. Gormley said: "There are a great many privately-owned freight cars in service today, due to the failure of the railroads in years gone by, for financial reasons or otherwise, to furnish all equipment needed for the movement of certain special types of traffic. With the exception of the brine-tank refrigerator cars, tank cars and a small number of other special-type cars, the railroads are today, through their ownership or through railroad-controlled private refrigerator lines, in position to furnish all equipment needed for the movement of the traffic of the country. There certainly can be no justification today for the extension of the ownership of private freight cars beyond what now exists. This is particularly applicable to stock and refrigerator cars."

Mr. Gormley commended the Mechanical Division for its work in connection with the standardization of materials and equipment in past years, more progress along this line having been made by the railroads than by almost any other industry. He closed his address with the following comments regarding standardization and railway efficiency.

"Nothing, of course, should be done that will interfere with individual initiative, and likewise the work should not be carried to the point where it could be called strangulation instead of standardization. But, on the other hand, the railroads are under the definite obligation to furnish transportation service in the most economical manner possible. The public generally should always keep in mind that the major part of the increase in efficiency since 1923 in the movement of traffic and economy in operation is the direct result of the large expenditures for improved cars, locomotives and other facilities, plus a better shipper co-operation in the handling of equipment through the regional shippers' advisory boards. The ability of the railroads to bring about further economies in the future depends largely upon their credit for financing continued improvements."

Address of Chairman Ayers

During the past year several important matters which will come before you in the committee reports have been worked out in cooperation with manufacturers, shippers, private-car owners, equipment builders, other divisions of the American Railway Association and federal authorities. This cooperation is an important factor in the work of the division and is highly appreciated by us. Some of these groups have been active over a period of years and it would have been difficult, if not impossible, to make as much progress as we have without their assistance.

Progress is being made in the development of special materials and the treatment of materials to meet special requirements of service. The railroads should give fullest consideration to these developments where they will prolong the life of the equipment between shoppings and reduce cost of maintenance. Therein, I think, lies one of our greatest opportunities for improvement.

The outstanding problem which confronts us today is, of course, to meet the prevailing condition of business. At no time within my recollection has the work of this division and other railroad-mechanical organizations stood out to better advantage than it does today, assisting the railroads not only to improve the speed and reliability of service, but at the same time to spend a continually diminishing proportion of gross revenue for maintaining and operating cars and locomotives. I desire to give full credit to those who have been helpful in assisting to carry on this work. The necessity as well as the opportunity for further improvement is growing rapidly larger rather than smaller and we must make even more progress in the future than we have in the past.

Report on Safety Appliances

The investigation of power brakes and appliances for operating power brake systems being conducted by the American Railway Association under order No. 13528 of the Interstate Commerce Commission has been continued during the past year. The road tests, which were under way at the time of the 1930 convention, have been completed and the records of the tests are being compiled, analyzed, and a report prepared. Reference is here made to the reports of the director of research at the annual meetings of the Mechanical division for the years 1925 to 1930 inclusive which present the progress up to June, 1930.

To review briefly, the road tests were started on August 1, 1929, with tests on the standard K brake equipment. This series of tests was completed January 3, 1930. The Westinghouse FC-5 equipment, which was designed to meet the tentative specifications of the Interstate Commerce Commission, was then installed on the test train, and each car was given a rigid inspection, draft gears and couplers dropped, broken parts replaced and renewals made to place the cars in the same condition as they were at the start of the Type-K tests. This work of making repairs and equipping the first 50 cars with Westinghouse Type FC-5 equipment was completed and tests were started on this equipment January 20, 1930. All tests with this equipment were completed June 4th, 1930.

In changing over from the Westinghouse Type FC-5 equipment to the type FC-3 equipment, all cars were given another thorough inspection, draft gears and couplers dropped, broken parts replaced, so that the cars were placed in the same condition as at the start of the standard K and type FC-5 equipment tests. This work was completed on 50 cars by June 10, 1930, and tests were started on the Type FC-3 equipment on that date. This equipment was submitted to the same schedule of tests as the other two equipments, which included level road tests, long moderate grade tests and heavy grade tests. This equipment was built in this form in order to fit the test rack at Purdue University and to facilitate changing over from the FC-5 equipment to the FC-3 equipment. The tests with this equipment were completed November 3, 1930.

As the results of the tests with the standard K, FC-5 and FC-3 equipments had not been entirely satisfactory, a series of research tests was made during the period from November 3, 1930, to January 17, 1931, to determine the features and requirements of a power brake equipment which would be satisfactory for long train operation. Special apparatus was installed on the test train which made it possible to vary and control the speed of brake application through the train and to vary and delay, if so desired, the type of brake application in various parts of the train. After these requirements and features of a satisfactory brake equipment had been determined, the Westinghouse Air Brake Company submitted the FC-3A equipment, a modification of the FC-3 equipment and embodying these features, to determine if a pneumatic brake equipment could be built which would meet these requirements. Tests on the FC-3A equipment were started on January 23, 1931, and completed March 31, 1931.

The tests on the FC-3A equipment completed the road tests, and the work of dismantling the test train was started April 1 and completed April 21, 1931. The Westinghouse FC-3A equipment was removed from all the cars and locomotives, the standard air brake equipment replaced on the cars and the cars were put in proper condition to return to their owners. All test apparatus and equipment belonging to the American Railway Association was shipped to Purdue University, Lafayette, Ind. for storage.

During the progress of the road test a group of men, located at Purdue University, have been compiling the data from the records of the road tests. The group of men working on the test train on the Pacific Coast, have returned to Purdue University and the two groups are now analyzing the records and preparing a report of the road tests.

James Triple Valves Tested

During the past year the James triple valves were tested on the 100-car test rack located at Purdue University and a report has been prepared covering the results of these tests. Twenty-five James valves were installed on the test rack with seventy-five standard K triple valves. All tests with the James equipments were 100-car tests and the James equipments were either the first 25 or the last 25 cars on the test rack.

The tests on the James valves were started February 10 and completed February 18, 1931. The schedule of tests consisted of 23 tests including service applications, emergency applications, releases after both service and emergency applications, cycling and graduated release tests. The rack tests on this equipment developed the following undesirable features:

There were failures of the James valves to apply with both the 10-lb. and 25-lb. service reductions. The James valves which did apply developed 21 per cent less brake force with a 10-lb. service reduction and 3.7 per cent less brake force with a 25-lb. service reduction than the standard K equipment.s

Forty-two per cent of the James valves failed to release following a 10-lb. service reduction when the James valves were on the rear end compared to no failures to release with the standard K equipments. To release these James valves it was necessary to bleed the auxiliary reservoirs.

The substitution of 25 James valves for 25 standard K equipments on the head end of the 100-car test rack delayed the service application of Car 100, 50.8 per cent. The times of application of the other equipments on the test rack were delayed proportionately.

The time of Car 100 to apply in emergency application was lengthened 26.7 per cent when 25 James valves were substituted for 25 standard K equipments. Experience gained from the road tests on the Pacific Coast has shown that lengthening the propagation time increases the severity of slack action and shocks.

There were 8 cases of undesired emergency applications during the running of the 23 tests on the James triple valves.

With regard to grade operation, the brake cylinder pressure developed by the James valve during a cycling operation cannot be controlled when the 25 James valves are located on the rear end of the 100 car test rack. The graduated release feature of the James valves consisted of holding the brakes applied until the brakes were partially recharged and then releasing at the same rate as in direct release position. During the graduated release tests on the test rack, 4.9 per cent of the James valves failed to apply and 17.1 per cent of these valves failed to release.

In view of the results of the tests on the James triple valve, it is recommended that this equipment be given no further consideration in this investigation.

The report was signed by H. D. Johnson, director of research, American Railway Association.

Discussion.—In connection with the report on the power brake tests, C. E. Chambers, chairman of the Committee on Safety Appliances made the following statement:

"All of the air brake equipments used in the road tests (except the standard Type K) were made up in experimental form so that various functions could be used or eliminated or different combinations of these functions could be easily set up. None of these equipments were reduced to a commercial form as no one knows what functions will finally be decided upon. Just before the A.R.A. undertook this investigation, the Interstate Commerce Commission issued its 'tentative specifica-

tions and requirements for power brakes and appliances for operating power brake systems,' which set forth the functions of a power brake, which, in the opinion of the Commission, were necessary. After the results of the road tests have been thoroughly analyzed and the report completed, it will probably be necessary for representatives of the A.R.A. and the Commission to meet together to decide upon the functions of the brake which will be agreeable to both parties. If it is finally decided that the present standard brake must be changed, and an agreement on the new functions of the brake has been reached, then any air-brake manufacturer will be at liberty to develop in commercial form the necessary devices."

Report on Locomotive Design and Construction

Counterbalancing of Locomotives.—At the A.R.A. convention at Atlantic City last June your committee submitted a method for the consideration of the association. Since then a number of locomotives have been counterbalanced by this method, the riding qualities of which are of a superior nature. Your committee now recommends this method of counterbalancing locomotives for adoption as recommended practice.

(Signed) S. S. Riegel, Sub-Committee.

Pressures for Mounting Driving, Trailing and Engine-Truck Axles and Crank Pins.—It is *recommended* that for mounting driving and trailing axles and crank pins into cast-iron centers, the desired pressure be based on 10 tons per inch of diameter with an allowable variation of 10 per cent over or under; for mounting driving and trailing axles and crank pins into cast-steel centers the desired pressure be based on 15 tons per inch of diameter with an allowable variation of 10 per cent over or under.

In mounting engine-truck axles it is recommended that present A.R.A. standard practice for mounting car and tender axles be followed.

In mounting it is recommended that a mixture of 12½ lb. of white lead to one gallon of boiled linseed oil be used as a lubricant. This should be mixed in quantity only sufficient for one or two days' operation, due to the drying quality of the boiled linseed oil. It should be stirred before applying. Do not use raw linseed oil or lubricating oils either alone or for thinning, as they do not dry and tend to work out in service, thus giving a false indication of loose axles or pins.

(Signed) J. C. Hassett, Sub-Committee.

Flange and Tread Contour for Engine-Truck, Driving and Trailer Wheels.—The investigation which has been conducted to date shows that it would be entirely feasible, and very desirable when viewed from the standpoint of economy, to have a single standard contour to be used on all wheels of both locomotives and cars. Eight roads report using flanges 1 in. high on driving and trailing wheels of freight locomotives. Six of these roads use flanges 1 in. high on driving and trailing wheels of passenger, as well as freight, locomotives. The experience of these railroads is ample to demonstrate the entire safety of flanges 1 in. in height on driving and trailing wheels of both passenger and freight locomotives.

The benefits of the reduced height of flange are sufficient that the Committee feels warranted in recommending that Fig. 2, page 7, Section "F" of the Manual, be revised to call for 1 in. instead of 1⅛ in., height of flange. The committee also recommends cooperation and further study with the Committee on Wheels that will lead to the development and adoption of a single flange and tread contour that will be adopted for all wrought-steel and steel-tired wheels of both cars and locomotives.

The sub-committee report was signed by H. H. Lanning (chairman), S. Zwight, H. M. Warden, Geo. McCormick, J. C. Hassett, and E. C. Anderson.

Eccentric Cranks.—The Committee's inquiry among various railroads has developed information to the effect that the design of eccentric cranks used in connection with valve gears of the Walschaert, Baker, and other types, which derive motion from main crank pins, is not a particularly live issue at this time, but it appears that more or less trouble, in the maintenance of these cranks, has been experienced on practically all railroads. The trouble experienced in each case seems to have taken one or more of the following forms: (a) Crank arms loose on main crank pins; (b) breakage either through the portion of crank arm surrounding the main pin or in the middle member connecting main-pin end with eccentric-rod end; (c) Keys working out of main pin fit and catching eccentric rod; (d) Threaded ends breaking off eccentric-rod crank pins.

The experience of most railroads reporting information to the committee has been that two bolts are necessary to prevent crank arms from becoming loose on main pins. Two roads recommended the use of two keys in addition to two bolts in cranks, as per Fig. 3. The main pin end shown on Fig. 3 appears to be most widely used, but the number of locomotives owned by roads recommending the construction of Fig. 4 is almost equal to that of roads favoring construction of Fig. 3. One railroad reports having abandoned the construction of Fig. 3 in favor of that of Fig. 4, while another railroad has taken exactly the opposite course.

The eccentric-rod end of Fig. 6 appears to be far more generally used than any other.

In view of the information set forth above, the committee recommends crank designs in which the construction of Figs. 3 and 4 are both included so as to provide for optional use. The construction of Fig. 6 is recommended for the eccentric-rod end; however, Fig. 7 is also shown for optional use. Crank arms designed in accordance with the committee's recommendations are to be made preferably of forged medium steel, in accordance with A.R.A. standard material specifications for axles, shafts and other forgings. However, the designs shown are satisfactory for electric cast steel. If forged, eccentric cranks made in accordance with these designs should be finished all over.

[The detail design recommended by the committee is omitted —EDITOR.]

The report of the sub-committee was signed by H. H. Lanning (chairman), S. Zwight, H. M. Warden, Geo. McCormick, J. C. Hassett, and E. C. Anderson.

Unification of Screw Threads

A review has been made by your committee of the screw thread standards shown in the 1924 report of the American Standards Association, designated therein as the "American Standard," and in the 1928 report of the National Screw Thread Commission, designated the "American National."

These studies have for the present been confined to screw threads for bolts, machine screws, nuts, and commercially tapped holes, though the future scope of work for this and other committees working on screw-thread standards may properly include those of special diameters, pitches, and lengths of engagement, screw threads for pipe, hose couplings, and other threads such as are now included in the activities of the National Screw Thread Commission.

For study and comparisons a table is included in this report showing the present A.R.A. threads and the "American" standards previously referred to.

As a result of its studies, particularly as to the screw-thread requirements of locomotives, this committee believes it practical and desirable to bring the A.R.A. Standard into harmony with that of the American Standards Association, except that it may be desired to retain three sizes, 1⅜ in., 1⅝ in., and 1⅞ in., omitted in the "American Standard." The change from three and one-half to four threads per inch for the 3-in. size will, it is believed, result in little or no confusion since bolts of that size are used but little on locomotives, and, since no sizes larger than 3 in. are listed in the new Standard, the present A.R.A. 3¼-in. to 6-in. Standard can be retained.

The National Screw Threads Commission and the American Standards Association have, as an important part of their work, developed a standard nomenclature for all terms descriptive of screw-thread elements, and standard identification symbols for indicating their character on drawings, specifications, stock cards, taps, gages, etc. There has also been established for general use, four classes of screw-thread fits. These, with the tolerances as developed, insure the interchangeable manufacture of screw-thread parts at separated places of production with assurance of a proper precision of fit in assembly. Screw threads have always varied in their precision of fit; however, this condition was not previously subjected to definite classification.

These refinements, while not included in present A.R.A. specifications of standards, are of distinct value and may be advantageously incorporated in new specifications developed.

While your committee reports favorable to the revision and amplification of the A.R.A. Standard to bring it into harmony with or conforming to the general character of the "American Standard," it believes that other committees of the Mechanical Division such as Car Construction, and Automotive Equipment are equally interested and any new Standard promulgated should be the result of the combined efforts of all groups affected. It is therefore recommended that this subject be referred back to the General Committee for submission to other committees of the Mechanical Division, or to a joint committee of all groups interested, including representation from the Engineering and possibly other divisions of the American Railway Association. Through united action, the

report as finally adopted would be with the approval of all groups involved and with the assurance of suitability for all ordinary equipment, apparatus, and structures used by railway companies.

The sub-committee report was signed by A. H. Fetters (chairman), S. Zwight, and L. A. Richardson.

Standardization of 300-Lb. Screw Pipe Fittings for Steam Locomotives

Last year, your committee was requested to follow up the standardization of unions, union ells, etc., with a set of 300-lb. A.R.A. screwed pipe fittings. Your committee learned that the Manufacturers' Standardization Society of the Valve and Fittings Industry and the American Standards Association had already prepared such designs.

Your committee now understands that the designs are completed and will be officially passed upon soon for adoption by the above association. Your committee sees no reason why they cannot be adopted by the A.R.A. as standard at this time. It is recommended that these designs be submitted to the members for adoption by letter ballot, this year, and that the Committee on Specifications and Tests of Materials be requested to prepare specifications covering material, tests and manufacture of these fittings.

The sub-committee report was signed by R. M. Brown (chairman), W. I. Cantley, S. S. Riegel, J. C. Hassett, and G. H. Emerson.

Standardization of 300-Lb. Globe and Angle Valves for Steam Locomotives

Last year, your committee was requested to take up the subject of standardizing globe and angle valves for 300 lb. pressure for use upon steam locomotives. Owing to the large amount of work involved in attempting to prepare designs for numerous sizes of valves, your committee decided that it would be best to start with one size, namely: 1¼ in., in an effort to work out this design of straight globe valve, completely, with the different members of the committee and also with the manufacturers.

It is recommended that this report be received at this convention only as information and that all of the members of the Mechanical Division send to the chairman of the sub-committee any comments or suggestions they may have upon the design in order that your committee can continue the work with the object of presenting a proposed standard for globe and angle valves to the convention in 1932.

The sub-committee report was signed by R. M. Brown (chairman), W. I. Cantley, S. S. Riegel, J. C. Hassett, and G. H. Emerson.

Design of and Repairs to Locomotive Springs

The Sub-Committee on Springs and Repairs to Springs submitted a supplementary report which will be helpful in the working of instructions contained in the 1929 report. The first installation of this system was started in 1925 and gradually developed, well established and had been running for a considerable period when the report in 1929 was made.

A prominent railroad when the subject was first investigated was confronted with a great accumulation of defective springs awaiting repairs, the plant being worked night and day to keep up with maintenance. Now the conditions have reversed and there is an accumulation of springs which have been made and repaired and in stock for service, and the broken springs are a matter of no concern.

It should be borne in mind that the system as recommended in the previous report applies to carbon-steel spring plates, and carbon-steel springs consistently manufactured by this process will stand test in which the set has been completely absorbed and reversed below the horizontal plane in deflection without failures after repeated application. In the case of double elliptic springs, the bands can be brought together and released repeatedly without failure. Springs which have developed failures, upon investigation, have generally shown that some defect existed in the steel or surface of the plate.

A further source of failure discovered is due to mixing the steel in the assembly of the plates of the spring wherein it has been found that alloy-steel plates have been made up with carbon steel. It was discovered that these alloy-steel plates can be readily detected when plates are in the heating furnace, showing a darker color than the carbon-steel plates when removed.

The sub-commitee report was signed by G. H. Emerson (chairman), H. A. Hoke, and W. G. Black.

The report was signed by W. I. Cantley, (chairman), mechanical engineer, L. V.; H. H. Lanning, (vice-chairman) mechanical engineer, A T. & S. F.; H. A. Hoke, assistant mechanical engineer, Penna.; G. McCormick, general superintendent motive power, S. P.; J. C. Hassett, mechanical engineer, N. Y., N. H. & H.; E. C. Anderson, mechanical engineer, C., B. & Q.; W. G. Black, mechanical assistant to the president, C. & O.; C. E. Brooks, chief of motive power, C. N. R.; G. H. Emerson, chief of motive power and equipment, B. & O.; A. H. Fetters, general mechanical engineer, U. P.; S. Zwight, general mechanical superintendent, N. P.; R. M. Brown, superintendent motive power, N. Y. C.; H. M. Warden, mechanical superintendent, M-K-T.; S. S. Riegel, mechanical engineer, D. L. & W., and L. A. Richardson, general superintendent motive power, C., R. I. & P.

Discussion.—The discussion indicated approval of the recommendations of the committtee for some reduction in the pressure of wheel fits. It was stated that many roads have had trouble with cracked wheels, largely due to the effect of expansion of the axles from hot journals. Such discussion as bore on the question of flange and tread contours supported the committee in its recommendation that a single flange and tread contour be developed for both car and locomotive wheels. In the matter of securing crank arms to main crank pins, the question was raised as to why the committee submitted two recommended designs rather than a single design and why keys were not depended upon to take the shear rather than the two types of bolts recommended by the committee.

Differences in water conditions, resulting in varying valve lubrication difficulties, were said by the committee to justify the submission of the two designs. The difficulty of producing sufficiently-tight fits on the keys when the crank arm is applied over the key was given as the reason for not depending upon the key to retain the crank arm in its correct position on the pin. When keys are applied after the crank arm is in place, they frequently work out and cause failures of the eccentric rods.

In presenting its proposed design for 300-lb. globe and angle valves, the committee asked for instructions as to the desirability of proceeding with the development of complete standard designs. A motion was carried instructing the committee to proceed with such designs and it was suggested that the yoke-type of valve be considered for use with high-pressure superheated steam, in addition to the bonnet-type shown by the committee. The entire report of the committee was submitted to letter ballot.

Storage-Battery Capacity Rating

A method for rating the capacity of lead and nickel-iron storage batteries was presented and recommended by the Committee on Locomotive and Car Lighting. Rate of charge, voltage limits, temperature, specific gravity and name plate data are specified. The report is identical in substance with that prepared by the Association of Railway Electrical Engineers and published in its proceedings, in its Manual of Recommended Practices and also in the October, 1930, issue of the Railway Electrical Engineer.

The committee consisted of W. E. Dunham (chairman) superintendent car department, C. & N. W.; E. P. Chase, assistant engineer, Penna.; H. A. Currie, electrical engineer, N. Y. C.; E. Wanamaker, electrical engineer, C. R. I. & P.; A. E. Voigt, engineer car lighting., A. T. & S. F.; F. O. Marshall, electrical engineer, Pullman Company; P. J. Callahan, supervisor car and locomotive electric lighting, B. & M.

Action.—The report was accepted and submitted to letter ballot.

Report on Car Construction

This committee gave consideration to a variety of subjects during the year and the report consists of several sub-committee reports dealing with specific subjects.

Design of Recommended-Practice Cars

Single Sheathed Box Cars—Inasmuch as no change in clearance outline has been made since the last convention no changes were made in this design.

Double Sheathed Composite Box Cars—Last year's report stated that the demand was for a single-sheathed composite car or a double-sheathed steel car and that consideration would be given to the omission of the double-sheathed composite car from the Supplement to the Manual. The sub-committee made this recommendation in the event that an increased clearance

outline is adopted and box-car designs are increased in size.

Steel Double-Sheathed Box Cars—The question of clearance outline is still unsettled therefore the sub-committee has not gone ahead with the design.

Composite Automobile Cars—The question of clearance outline is still unsettled and the sub-committee has not made any progress on the design. Recommendations were made for a single sheathed composite automobile car with 12-ft. clear door openings, staggered, one design 40 ft. 6 in. inside length and the other 50 ft. 6 in. inside length, both 50 tons capacity.

Self Clearing Hopper Cars—All drawings for 50- and 70-ton hopper cars, class 4D-HT-2 and 4E-HT-2 have been completed, including alternate design of narrow end construction, and are now shown in the Supplement to the Manual dated March, 1930.

The Wine Railway Appliance Company, Toledo, Ohio, holders of certain patents which affect the narrow end construction of hopper cars, has made a waiver of patent rights to railroads or car owning companies which are members of the American Railway Association, copy of this license being on file in the office of the Secretary of the American Railway Association, 30 Vesey street, New York, where it can be referred to and consulted by anyone interested. The scope of this waiver covers only the specifications contained in drawings attached to Circular No. 2838, issued by the American Railway Association on July 1, 1930.

Fundamentals of Car Design—No changes involving the basic method of calculation were made during the year. Investigation by individual roads of the weight-reducing possibilities of alloy steels is suggested. The use of such alloy steels in new cars initiates the suggestion that some provision should be made to avoid the substitution of lower strength materials when repairs are made.

Equipment Clearances and Maximum Outline of Proposed Recommended-Practice Cars—A questionnaire has been sent out to all roads requesting information that would enable representatives of the Mechanical Engineering Transportation and Traffic divisions of the A. R. A. to select a satisfactory limiting outline for a car having 9 ft. 2 in. inside width; 10 ft. inside height and 50 ft. 6 in. inside length. Questions have arisen as to the information necessary, and a recheck of the entire matter is required. As soon as the satisfactory limiting outline is decided upon the work of completing the various car designs will be carried forward.

Center-Plate Height—In view of the recent developments in the design of car parts and the possibility of the use of trucks having normal capacities in excess of those now in use no reduction is advisable in the present standard truck center-plate height of 26¾ in. Therefore, the sub-committee reports, the dimension will be maintained.

Letter-Ballot Items

It is recommended that the following items be submitted to letter ballot:

Truck Bolsters, Design-Test Requirements—When the present design-test requirements for truck bolsters were adopted in 1926 it was intended to cover all truck bolsters whether of cast steel or built-up type. At that time there was some question as to the possibility of built-up bolsters being made to meet these requirements. In order to give time to develop the situation with respect to built-up bolsters a note was shown on the title page of the specifications as printed in Section A of the Manual, exempting built-up bolsters from the specifications.

No form of built-up bolster has been submitted which will meet the requirements. It is therefore, recommended by the committee that this note be omitted from the specifications, effective March 1, 1932.

Stake Pockets for Flat Cars.—Since the adoption of stake pockets for recommended practice in 1928 shown on page 28-A, section C of the Manual, the Committee has been instructed to revise the drawing to show rounded corners to prevent cutting wires, cables and other fastenings. It was also felt that pockets should be redesigned for greater strength and that the cast pocket secured with U bolts eliminated.

The Committee has accordingly prepared a design, increasing the depth of outside wall and another design with pressed ribs, decreasing the thickness of material from ½ in. to ⅜ in. minimum and specifying round edge material.

Elimination of Pressed-Steel Journal Boxes.—Recommendation is made that Rule 3 be amended to prohibit the application to new cars after January, 1933, and that existing cars so equipped cannot be accepted from owner after January, 1938.

Journal Box and Pedestal.—In accordance with instructions received from the Car Construction Committee, the sub-committee has redesigned the journal box for the 5-in. by 9-in. journal, as shown between pages 22 and 23, Section D, in the present manual, so that it may be used with the flat-face pedestal and can be manufactured with or without liner. The sub-committee has also designed a flat-face pedestal for the 5-in. by 9-in. and 5½-in. by 10-in. journal box.

Design of Journal Wedges.—Recommendation is made that the note on page 25, section D of the 1928 Manual be revised to read "Wedge shall be of forged or cast steel," thereby eliminating the malleable-iron wedge.

Limits for Coupler Heights on Passenger Cars.—It is recommended that the following be referred to letter ballot for adoption as standard.

For passenger-carrying cars: Nominal height, 34½ in.; maximum height, 35 in.; minimum height of coupler, 33 in.

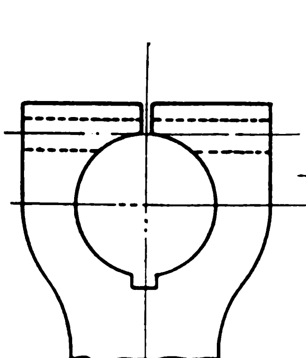


Fig. 1

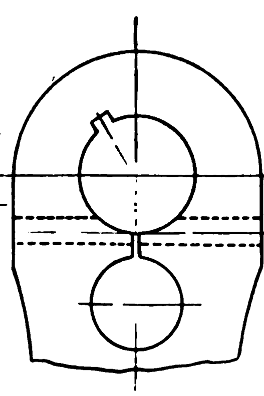


Fig. 2.

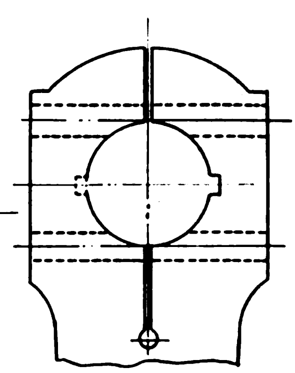


Fig. 3.

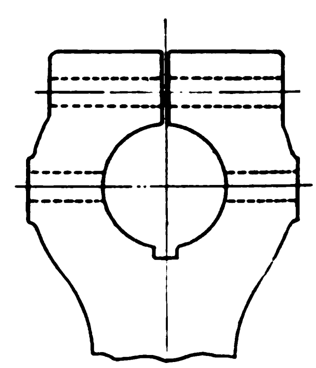


Fig. 4

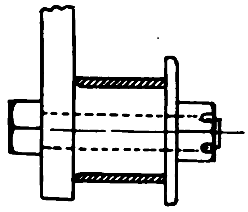


Fig. 5.

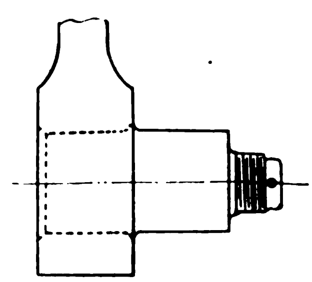


Fig. 6.

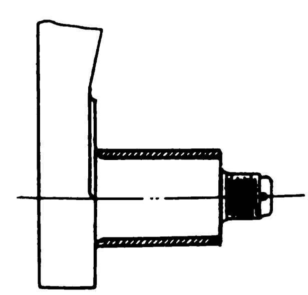


Fig. 7.

Types of eccentric cranks according to classes of connections

Load-carrying passenger equipment cars shall meet I.C.C. and A.R.A. requirements for coupler height, as prescribed for freight cars.

Definitions and Designating Letters for Freight Cars.—Attention has been called to the fact that the symbol "RP"—Iceless Refrigerator, is incomplete in that it covers only cars where protection is provided against heat. It appears that a number of cars of this type have been constructed which provide protection against both heat and cold.

In view of the above, it is recommended that the definition for "RP" car as now shown in Section L of the Manual be changed to read in accordance with the following proposed form: "RP—Iceless Refrigerator. A house car equipped with insulation, with or without means of ventilation, and provided with apparatus or other device for furnishing protection against heat and/or cold."

Brine Valves and Operating Rigging, Rules For.—In order to allow greater latitude in the design and construction of brine tanks and their accessories and to be in conformity with present day practice, the Car Construction Committee recommends that rules covering this subject adopted as Standard in 1922 and shown on pages 10-A and 10-B, Section L of the Manual, be modified. It is recommended that the present rules be allowed to remain without change but be supplemented by the addition of the following note: "Cast- or pressed-steel parts will be considered permissible alternates whenever malleable iron is mentioned in the above rules and it will also be permissible to weld, instead of rivet and solder, all brine-tank joints."

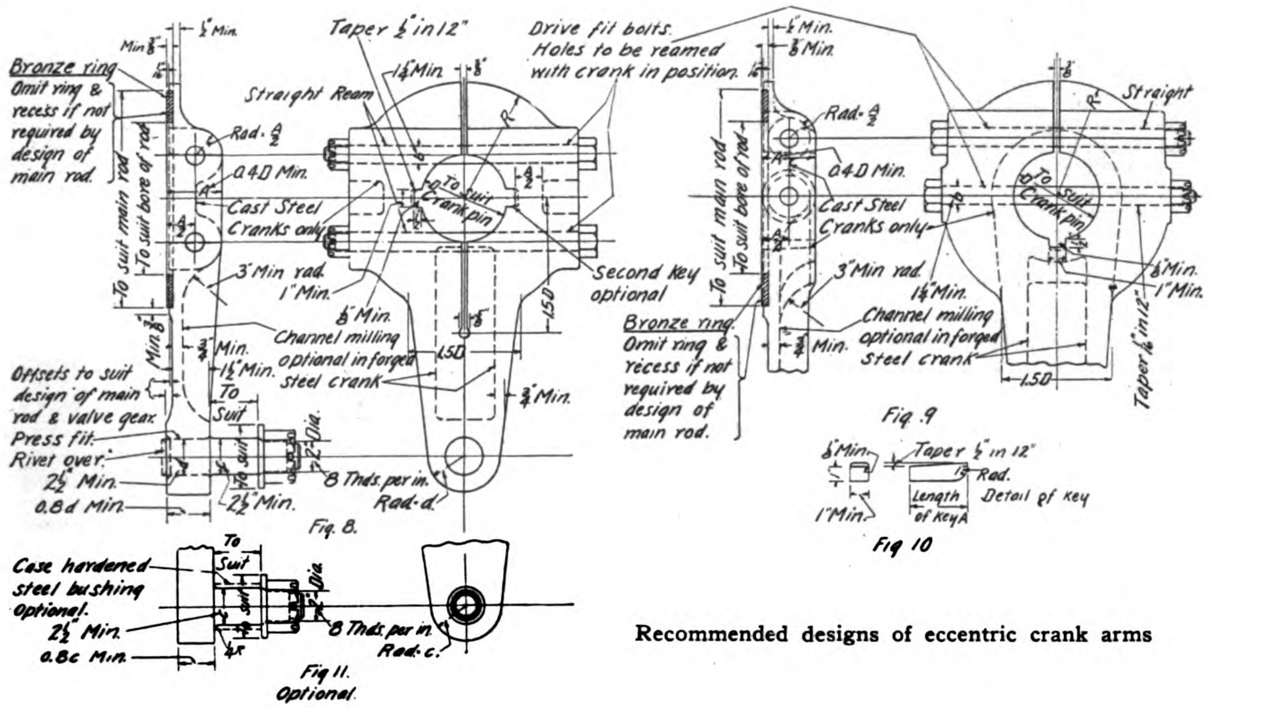
The sub-committee on the design of truck springs reports that the work on designs of coil springs for 50- and 70-ton capacity cars having greater capacity than the present designs is progressing but has not been completed.

The sub-committee on rail-motor-car axles reports progress in an effort to determine the causes of excessive thermal checking. There is a possibility that an improvement in brake-beam construction used with the rolled steel wheel to reduce the tendency of the brake shoe to overlap the outside edge of the wheel rim or the changing of the spacing of the brake shoes so that they will run closer to the flange of the wheel may offer some solution to the problem.

The sub-committee on journal-box lids is co-operating with manufacturers of side frames and box lids with a view to preparing specifications and can only report progress at this time.

Axle Loads—Interchange Rule 86.—In the Annual Report of the Committee for the year 1930, reference was made under the above heading to the fundamental principles of A.R.A. Interchange Rule No. 86, and a table presented showing the effect on axle loads due to variations in weights of wheels. It is the recommendation of the committee that, in view of complications which inevitably would result if variations in weights of various types of wheels were to be considered, no change be made in the present method of arriving at the rail-load limits as prescribed in interchange Rule No. 86 for the various sizes of axles.

The report was signed by P. W. Kiefer (chairman), chief engineer motive power and rolling stock, N. Y. C.; W. A. Newman (vice-chairman), chief mechanical engineer, C. P. R.; A. H. Fetters, general mechanical engineer, U. P. System; C. L. Meister, mechanical engineer, A. C. L.; J. McMullen, superintendent car department, Erie; F. A. Isaacson, engineer car construction, A. T. & S. F.; W. O. Moody, mechanical engineer, I. C.; C. B. Smith, engineer tests, B. & M.; T. P. Irving, engineer car construction, C. & O.; S. O. Taylor, master car builder, Mo. P.; G. S. Goodwin, assistant general superintendent motive power, C. R. I. & P.; J. J. Tatum, general superintendent car department, B. & O.; E. B. Dailey, engineer car construction, S. P.; B. S. Brown, assistant engineer, P. R. R.; K. F. Nystrom, superintendent car department, C. M. and St. P. & P., and J. P. Laux, superintendent motive power, L. V.



Recommended designs of eccentric crank arms

and expresses the hope that definite designs can be submitted within the next year.

As a result of the increasing use of roller-bearings under cars and locomotives the committee has been approached by several manufacturers with reference to a permissible increase in axle load at the journal on A.R.A. axles equipped with roller bearings. Inasmuch as an increase in permissible load would increase the stresses at the wheel seat and at the center of the axle, the whole question, pertaining to both cars and locomotives, will be given careful consideration during the ensuing year and will be referred to the committee in charge of A.R.A. axle design for an analysis of the stresses and their recommendation.

The sub-committee on loading devices in automobile cars is conducting an investigation with a view to preparing designs of representative devices suitable to the various types of automobile cars and when completed will be issued, with recommendations, in circular form.

The sub-committee on thermal checking of rolled-steel wheels is working with the wheel committee and the brake committee

Action.—The report was accepted and necessary recommendations referred to letter ballot.

Electric Rolling Stock

The major part of the report of the Committee on Electric Rolling Stock consists of a tabulation, showing the electric locomotives placed in service during the year ending June, 1931. The table lists the principal locomotive characteristics and includes ten locomotives for the New York, New Haven & Hartford, four for Chile, 14 for Switzerland, five for Norway, eight for Russia and 12 for Italy. This table was compiled with the cooperation of the Heavy Traction Committee of the American Electric Railway Engineering Association.

The report also records the completion of the Cleveland Union Terminal and Delaware, Lackawanna & Western electrifications and the installation of 43 three-powered, oil-battery-electric locomotives. Thirty-five of these have been placed in service on the west side lines of the New York Central, four on the Michigan Central, two in the LaSalle street, Chicago, terminal of the New York Central and two for switching service in conjunction with the Lackawanna electrification.

Concerning the development of alternating-current traction motors, the report states: "Electrification of certain sections of railroad has made some progress during the year, and it is the thought of the committee that the progress will be more rapid in that a satisfactory single-phase, alternating current motor for locomotives has been designed. This new type motor is the result of the combined efforts of the two largest electrical manufacturing companies and they are now in position to build motors with identical characteristics and dimensions, which will permit interchangeability."

The committee consisted of R. G. Henley (chairman) superintendent motive power, N. & W.; J. H. Davis, chief engineer electric traction, B. & O.; J. V. B. Duer, electrical engineer, Penna.; J. W. Sasser, superintendent motive power, Virginian; R. Beeuwkes, electrical engineer, C. M. St. P. & P.; L. C. Winship, electrical engineer, B. & M.; H. A. Currie, electrical engineer, N. Y. C., and A. L. Ralston, mechanical superintendent, N. Y. N. H. & H.

Action.—The report was accepted.

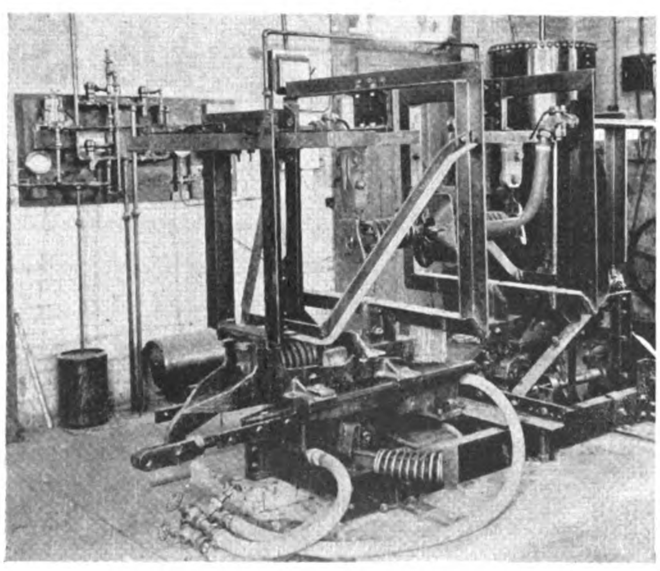
Safety in the Shop

By Charles G. Sebrell*

In introducing his paper Mr. Sebrell pointed out the need of the supervising officer being thoroughly sold on the idea of safety himself before attempting to sell the idea to the organization. The efficient supervisor of today, he stated, must become thoroughly acquainted with the viewpoint of his men, hold friendly meetings with them and frankly solicit honest constructive suggestions. He stressed the need of a clean and orderly shop as a fundamental requirement of safety. Observance of goggle rules, he stated, was not brought about over-night nor have the improvements thus far made been easy of accomplishment. However, selling to the workman the idea that goggles were his individual insurance against any impairment of his vision has accomplished results that are gratifying both to the men and to the management.

In conclusion, Mr. Sebrell pointed out that safety must not be regarded as a philanthropic undertaking, but must also be considered as good business. The basic need in accident prevention, he said, is "supervision with a super vision," an ability to observe what is transpiring, and an efficiency that will stop minor irregularities before they become major offenses.

* Shop Safety Supervisor, Atchinson, Topeka & Santa Fe.



The oscillating machine for studying connector action due to horizontal and vertical movements

Train-Line Connectors

In September, 1929, the joint committee on Automatic Train-Line Connectors representing the American Railway Association, the Bureau of Safety of the Interstate Commerce Commission and representatives of the four train-service brotherhoods, agreed that an investigation of automatic train-line connectors, including laboratory tests and road tests under actual service conditions should be made. This investigation was to be made by the American Railway Association cooperating with the Bureau of Safety and the train-service brotherhoods. The joint committee of the American Railway Association appointed a sub-committee to have direct supervision over the conduct of this investigation composed of the following members: C. E. Chambers, chairman of sub-committee, and chairman of Committee on Safety Appliances; R. L. Kleine, chairman of Committee on Couplers and Draft Gears; G. H. Wood, chairman of Committee on Brakes and Brake Equipment.

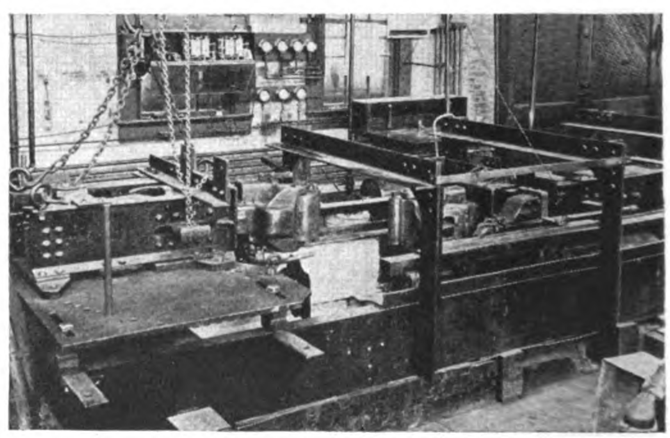
In undertaking this investigation the policy was adopted of making it extensive and complete and of giving each device the same opportunity to qualify for the tests as any other device. Forty-one companies or individuals have submitted plans, or specifications for our consideration. These plans are submitted to searching analysis and those devices having sufficient merit are being purchased in small quantities for testing in the laboratory.

Tests

Devices Purchased for Test—Up to the present time six freight and six passenger connectors of each of the following types have been ordered: Robinson wing type, Robinson Connector Company; Robinson pin-and-funnel type, Robinson Connector Company; American, Consolidated Connector Company; Roberts, Roberts Automatic Connector Co., Ltd.; Workman-Robinson, Workman-Robinson Company; National, National Connector Company; Cobb, Cobb Connector Company.

Prices have been requested on six freight and six passenger connectors from the McTaggart Connector Company, and the Johnson Connector Company, but orders for these connectors have not yet been placed. A further study of the specifications may indicate that the devices proposed by other manufacturers should be obtained and submitted to the laboratory tests.

At the start of this investigation there were no specifications covering the requirements for automatic train-line connectors and no schedule of tests for these devices. A schedule of



The impact machine representing the installation of couplers; draft gears and automatic train-line connectors on the ends of two cars

laboratory tests was prepared and copies forwarded to the Bureau of Safety, Interstate Commerce Commission, and to members of the committee having the matter in charge for the railroads. Criticisms and suggestions were invited and the schedule revised to include the suggestions received.

Testing Machines—Two testing machines, designed to carry out the tests specified in the schedule, were purchased and installed in the laboratories of Purdue University. The No. 1 or impact machine represents the installation of couplers, draft gears and train-line connectors on the ends of two cars. On this machine the action of the connectors is being studied with the drawbars in various positions of height, angularity repre-

senting laterally curved track, and in different positions of lateral off-set.

The No. 2 or oscillating machine is designed to study the action of the connectors and the wear on their various parts due to continual coupling and uncoupling and due to horizontal and vertical movements such as would be produced on a moving train.

[The report indicates that laboratory tests have already been made or are in progress on Robinson wing type and pin-and-funnel type freight connectors, the American freight connector and the National freight connector, and will be continued until each type which will be purchased has been tested.—EDITOR.]

The laboratory tests should select those devices which have sufficient merit to warrant their further study under actual service conditions in road tests.

The report was signed by H. A. JOHNSON, director of research, A.R.A.

Action.—The report was accepted.

Brakes and Brake Equipment

Our inspection of some reclamation plants reveals the fact that there are numerous types or designs of brake beams of varying dimensions, all of which, no doubt, originally met the brake-beam test requirements. These various dimensioned brake beams quite naturally came into existence due to the absence of definite and fixed dimensions.

The brake beam manufacturers undoubtedly sought to give the best possible brake beam for the lowest possible cost, which prompted them to employ structural shapes and designs most conveniently obtained. It is only fair to state that the railroads, for the most part, purchased brake beams from the most favorable quotations regardless of the type, quality of material or workmanship, thus contributing their share to the present conditions. Therefore, of necessity the present condition involves one of two things where standardization is desired, i. e., the railroads must carry stocks of the many varieties, shapes and styles of brake-beam parts in order to maintain the brake beam designs that the present market provides, or scrap such beams and their parts removed from cars in interchange as will not interchange to the road's standard.

For many years the A. R. A. manual has shown the association's standard brake beam not only by important dimensions, but also by shape of parts and their structure, but the necessary details for standardizing have been absent. Therefore, we have made no change in the present standard except to add thereto additional information so as to provide for complete details of standard No. 2 plus brake beam. In preparing these details we sought to specify such materials as are commercially obtainable, and such dimensions as may be conveniently met. The workmanship and inspection, in our opinion, will be a matter for the purchaser.

[The committee here included drawings giving recommended detail dimensions of standard No. 2-plus brake beam parts and devoted several paragraphs to an explanation of the reasons for the design and dimensions shown. It suggested the adoption of these details as recommended practice and called attention to the fact that A. R. A. brake-beam gages would need corresponding revision. In order to protect brake-pipe and signal couplings against damage by being incorrectly connected to signal-hose and brake-pipe-hose dummy couplings, respectively, the committee recommended two designs of dummy coupling which can be readily distinguished one from the other. The Subcommittee on Standardization of Contour Lines and Steam-Hose Couplings made a careful survey of general coupler-head conditions, finding much irregularity, and recommended a definite radius of the gasket seat in the coupler head as well as certain other details of construction, and gages for checking new heads. The committee studied the location of air, signal, train-line and steam-head pipe on passenger-equipment cars, finding a wide variation in practice without any apparent reason in most cases. A drawing showing a recommended standard location was included in the report. The committee reported that the new triple-valve graduating spring, adopted last year, is not being applied as rapidly and generally in freight equipment as desirable in order to eliminate undesired emergency action during service operation, and recommended that the older type springs be removed and scrapped whenever triple valves are cleaned and repaired.—EDITOR]

This committee was requested to cooperate with the committees on wheels and car construction in investigating the subject of thermal-checked steel-tread wheels, and in joint session at Chicago on April 8 it was the consensus that in-so-far as concerns brakes and brake equipment, the situation might be relieved somewhat through: Improvement in brake beam constructions and design, so as to reduce the tendency of brake shoes to overlap the outside edge of the wheel rim; better maintenance of foundation brake gear on trucks to reduce tendency of brake shoes overlapping outside edge of wheel rim; improvement in quality of brake shoes to eliminate, or minimize, groove cutting in wheels which in turn is conducive to thermal checking.

The question of brake shoe material is a broad one, and we believe should be investigated jointly by the Committees on Wheels, Specifications and Tests for Materials, and Brakes and Brake Equipment.

The report was signed by G. H. Wood (chairman), supervisor air brakes, Atchison, Topeka & Santa Fe; T. L. Burton, air brake engineer, New York Central; B. P. Flory, superintendent motive power, New York, Ontario & Western; R. C. Burns, assistant engineer, Pennsylvania; W. J. O'Neill, general mechanical superintendent, Denver & Rio Grande Western; W. H. Clegg, chief inspector air brake & car heating equipment, Canadian National; Mark Purcell, general air brake inspector, Northern Pacific; R. B. Rasbridge, superintendent car department, Reading; G. E. Terwilliger, supervisor auxiliary equipment, New York, New Haven & Hartford; M. A. Kinney, general master mechanic, Chesapeake & Ohio; H. A. Clark, general air brake inspector, Minneapolis, St. Paul & Sault Ste. Marie.

Discussion.—Representatives of several railroads concurred in the opinion that the weakest point in present brake-beam design is the brake head, which is too rapidly cut out by the brake shoe, owing to the lack of adequate bearing surface between the shoe and the head. A design of brake head improving this condition, which was developed by J. McMullen, superintendent of the car department of the Erie, and submitted to the Committee on Brakes and Brake Equipment by the Car Construction Committee, was commended by representatives of railroads which have applied heads of this type. In view of the strong sentiment for the improvement of this feature of the brake-beam design it was referred back for further development jointly by the Committee on Brakes and Brake Equipment, the Car Construction Committee, and the Committee on Specifications and Tests for Materials. In view of the belief that many reclaimed brake beams are going into service which are not of adequate strength, a motion was carried that the committee be asked to develop standards to which rebuilt or repaired brake beams must conform.

The remainder of the report was submitted to letter ballot, as recommended by the committee.

Report Arbitration Committee

During the year Cases 1656 to 1683, inclusive, have been decided and copies forwarded to the members.

As announced in the report to the 1929 Annual Meeting, investigation has been made to ascertain if it would be practicable to reduce billing costs by elimination of detail labor charges and overhead, and the use of an arbitrary percentage to be added to the material costs. The report of the sub-committee on this subject is attached. As a result of analysis of the data accumulated in this study, your committee has approved the recommendation of this sub-committee that the proposed plan be abandoned.

Rule 2—The committee recommends that Section (j) of this rule be modified to include section (d) of the Safety Appliance Acts to definitely indicate reason for rejecting equipment in violation of Section (d) of this Act.

Rule 3—The committee recommends that no extension be made in the effective date of fifth paragraph of Section (b). The committee recommends that note following first paragraph of Section (c) be modified, effective August 1, 1931, to authorize use of the Type E coupler adopted as recommended practice by letter ballot.

The committee recommends that the effective date of the last sentence of Section (d) and that the effective dates of the first and second paragraphs of Section (f) be extended to January 1, 1933.

The committee recommends that the exception in the fifth paragraph of Section (t), governing the interchange of cars used in transporting commodities such as asphalt, fuel oil, lubricating oil, be modified to include those cars used in transporting syrup, corn oil, molasses, grease, soap stock etc.

The committee recommends that no extension be made in the effective date of the sixth paragraph of Section (t) and that the same be modified, effective August 1, 1931, to except tank cars used in transporting commodities such as lard, soap stock, grease, molasses, syrup, etc., and so stenciled.

The committee recommends that the effective date of the

seventh paragraph and eighth paragraphs of Section (t) be extended to January 1, 1933. It is the intent that no further extension of the requirement in the eighth paragraph of Section (t) will be granted.

The committee recommends, as a safety measure, a new last paragraph to Section (t), to read as follows:

Proposed Form—(t) (12) Tank cars with dome covers not secured to tank by means of hinge or chain will not be accepted after January 1, 1933. From Owners.

Rule 4—The committee recommends that Section (c) of this rule be modified, as follows:

Proposed Form—(c) Refrigerator cars. When sheathing is split, broken, raked full width of board into wood to bottom of bead, or when raked into wood to lesser depth (*whether or not full width of board)* if *such* rake damage is in excess of four inches ***measured vertically, or where combined vertical width of two or more such rakes is in excess of four inches (within a vertical distance of twelve inches).*** (Bottom of bead on A. R. A. Standard sheathing is ⅛-in. below outside face of sheathing.)

The committee recommends that Section (f) of this rule be modified by adding the following phrase to the Section as it now stands: *"or in the case of box or stock cars, single-sheathed, where the bending of posts or braces by raking prevents the proper operation of side doors."*

The committee recommends that Section (g) of this rule be modified as follows:

Proposed Form—(g) All Cars. Metal end sill when straightening of same is necessary for proper operation of uncoupling apparatus, or dumping device; to restore safety appliances to original alinement *or to repair cardable directly associated defective parts.*

The committee recommends the addition of new second paragraph to Section (g), to read as follows:

Proposed Form—Defect card shall not be required for damaged push-pole pocket when not directly associated with other delivering-line defects.

The committee recommends that Section (j) of this rule be modified, as follows:

Proposed Form—(j) When a car is received home with unfair usage defects covered by defect card; or in any other cases where cars damaged by unfair usage are interchanged with visible defects covered by defect cards; upon arrival of cars at owners' shops, if it develops that there are associated defects due to unfair usage, joint inspection, within 90 days after first receipt of car home, *shall* be made by representative of car owner and a representative of a disinterested railroad, or by a chief interchange inspector, showing list of the defects covered by the defect card as well as list of additional *associated* unfair usage defects *which, in their opinion, occurred at same time (except interior fire damage per Rule 32, Section "k").* Such joint inspection certificate shall be forwarded to the road *issuing the defect card who shall issue defect card* to cover such additional defects.

Rule 8—The committee recommends that a note reading "Must not have carbonized back" be added to the wheel and axle billing repair card forms shown on pages 220 and 221 of the current Code of Interchange Rules. Carbonized backs deface billing repair cards and are unsuitable for filing purposes.

Rule 9—The committee recommends that third requirement opposite item of "A. R. A. couplers, or parts thereof, R. & R." be modified, effective August 1, 1931, as follows:

Proposed Form—(Where 12¼-in. head coupler, A. R. A. type D coupler *or A. R. A. type E coupler* is removed or applied, it must be so stated.)

Rule 17—The committee recommends a new paragraph to Section (c) of this rule, effective August 1, 1931, to read as follows:

Proposed Form—Type E Recommended Practice coupler, or coupler having type D head designed with swivel or radial butt, should be replaced in kind when available; otherwise same may be replaced with A. R. A. Standard type D, 6 by 8-in. shank couplers, and such substitution shall not constitute wrong repairs.

Rule 32—The committee recommends that the third paragraph of this rule be modified to apply to tank cars equipped with bolster of center anchorage. Damage of this nature to cars equipped with head-block anchorage should properly be the responsibility of the car owner.

The committee recommends the addition of a new seventh paragraph to this rule, to read as follows:

Proposed Form—Friction draft gear missing complete in interchange, including followers when missing in connection therewith, or when wooden block is substituted for draft gear. (The substitution of springs and followers for friction draft gear will be considered wrong repairs and cardable only by company applying same.)

The committee recommends that Section (a) of this rule be modified, to include *loose* as well as broken, bent or missing part causing derailment in order to definitely indicate responsibility in such cases.

The committee recommends that Section (o) be modified by eliminating the word "Also" at the beginning of the second paragraph, to clarify the intent of the rule.

The committee recommends that Interpretation No. 7 to this rule be modified, as follows:

Proposed Form—(7) Q.—Is a car owner responsible for steam inlet and ***steam*** outlet caps missing from tank cars?

A.—Yes, except as otherwise provided in this rule.

Rule 35—The committee recommends that last sentence of note following this rule be modified in the next supplement, as follows:

Proposed Form—Doors equipped with locks having two notches must be engaged and locked in second notch *on at least one side of door (providing maximum opening does not exceed three inches),* to be considered safely secured in closed position.

Rule 36—The committee recommends that the third paragraph of Section (1) be modified to include the statement: "No card with red background permitted." To avoid confliction with I.C.C. Regulations for Transportation of Explosives and other dangerous articles. This recommendation has been approved by the Transportation Division. American Railway Association.

The committee recommends, that, for same reason given above, the following sentence be added to the second paragraph of Section (2) of this rule: "No printing in red type or in any color on red background permitted."

Rule 44—The committee recommends that to clarify the intent, Section (1) of this rule be modified by including the following sentence: "(Any sill broken partly old at point of breakage will not be considered in this combination.)"

The committee recommends that to clarify the intent, Section (2) be modified as follows:

Proposed Form—Composite wooden and steel underframe cars. When five or more *steel or wooden* longitudinal sills are damaged, providing three or more *of the steel or wooden* longitudinal sills are broken *entirely* new *at point of breakage.*

The committee recommends that Section (3) and Interpretation 2 to this rule be eliminated, and Section (5) modified, as follows:

Proposed Form—(5) All-steel underframe cars having two *or more* steel longitudinal sills. *When two steel center sills are damaged between body bolsters.* When the damage is confined to the sills between the end sill and body bolster, owner will be responsible, providing after investigation it is found that car was not subjected to unfair handling as provided by Sections (a), (b), (c), (e), (f), (m) and (o) of Rule 32.

Reason—To eliminate side or intermediate sills as combination factors on all-steel underframe cars. It is felt present Rule 44 affords more protection to steel underframe cars with weak center-sill construction but having side sills, than it does to the more substantial A. R. A. center-sill construction without the side sills, while the impact shocks are not transmitted to the side sills in steel underframe construction but are concentrated upon the center sills. The use of all longitudinal sills as combination measure in wood underframe and composite wood and steel underframe, is consistent, in view of the end sill and body bolster transmitting the impact shocks to all such sills in more or less degree.

The committee recommends that to clarify the intent, Section (6) be modified as follows:

Proposed Form—(6) Steel tanks of tank cars, where secured by bolster or center anchorage, *if shifted account of all anchor bolts, or rivets being sheared off. Note.—Tanks shifted account elongation of bolt or rivet holes, where any of the bolts or rivets are still in place, is owner's responsibility.*

Rule 60—As a measure of economy and to expedite the work when the spray method of painting is employed, the committee recommends that section (f) of this rule be modified as follows:

Proposed Form—(f) All old cleaning marks must be scraped off and painted over with quick-drying paint, *preferably black.*

The committee recommends that Section (i) of this rule be modified, as follows:

Proposed Form—(i) In the event air brakes *are* cleaned, due to *being* inoperative, within nine months from date of last previous cleaning, car owner is responsible, except under the following conditions:

1. If cleaned *by same road* within sixty days from date of last previous cleaning, charge for such subsequent cleaning is not permissable, except where *due to* broken cylinder, triple valve body or check valve case, account owner's responsibility.

2. If cleaned *by* different roads, or *by* private car lines, within sixty days from date of last previous cleaning charge for such previous cleaning (per Items 18, 23 and 29, Rule 111) shall be withdrawn; except where last cleaning was occasioned by delivering line defects, or *due to* broken cylinder, triple

valve body or check valve case, account owner's responsibility.

3. Where last previous cleaning was due to delivering line defects (for which no bill was rendered against owner), the road performing same shall issue counter-billing authority for the expense of the subsequent cleaning, if performed within sixty days from date of such previous cleaning, upon presentation of copy of billing repair card of road rendering bill against owner, except where such subsequent cleaning was due to broken cylinder, triple valve body or check valve case, account owner's responsibility.

4. In any case, where *such subsequent* cleaning *within sixty days is performed* by car owner, joint evidence per Rule 12 shall be used to establish the defective condition which occasioned such cleaning.

Rule 87—The committee recommends that to clarify the intent, the phrase, *"on basis of sufficient evidence,"* be eliminated from the fourth paragraph.

Rule 102—The committee recommends that the third sentence of the second paragraph of this rule be modified to read:

Proposed Form—The same scale will apply to width, except for matched sheathing, roofing, lining and flooring, *on which for finished width up to and including 3½ in., consider as 4 in. rough; over 3½ in. up to and including 4½ in., consider as 5 in. rough; over 4½ in. up to and including 5½ in., consider as 6 in. rough; and upward on corresponding scale.*

Rule 104—The committee recommends that fourth paragraph of this rule be modified, effective August 1, 1931, as follows:

Proposed Form—In the case of *type "E" Recommended Practice coupler, or* swivel butt coupler (including swivel butt casting and pin), or radial butt coupler (including radial butt casting), removed account defective, credit for second-hand parts shall be at 75 per cent of prices new as shown in Rule 101. In case of complete *type "E" Recommended Practice coupler or coupler having type "D" head designed with swivel or radial butt, missing under the provisions of Rule 95, and substituted with A. R. A. type "D" Standard 6 by 8-inch shank coupler, the car owner shall be allowed credit, if any, for the difference in value between second-hand coupler missing and second-hand value of coupler applied.*

Rule 113—On account of the order of the Interstate Commerce Commission, I.C.C. Docket No. 17,801, relative to Per Diem Rules, the committee recommends that the second paragraph of this rule be eliminated, effective August 1, 1931. Your committee will give further consideration to this subject.

Rule 120—The committee recommends that repair limits for labor on car body per Section (b) of this rule be modified, repair limits for labor on tank cars complete be $50 and Section (d) modified as follows:

Proposed Form—(d) In no case shall the total charge for actual repairs to body *of all-steel or steel-underframe cars, or tank cars complete,* exceed the estimate by more than $50, *or on other types of cars by more than $25,* exclusive of betterments, unless authorized.

Reason—To provide greater measure of protection against heavy repairs to units which car owner may not desire to maintain; also, to provide limits for repairs to tank cars without authority from car owner.

[The proposed limits for labor charges on car-body repairs, included in tabulated form under Section (b) of Rule 120, not included here, show for each type of car of wooden construction a reduction under the present allowances. The reductions vary from 25 per cent to 50 per cent of the present allowances.—EDITOR]

Passenger Rule 2—The committee recommends that the effective date of the first sentence of Section (c) of this rule be extended to October 1, 1932 since the present situation justifies the extension.

The committee recommends that a new Section (d) be added to this rule, to read as follows:

Proposed Form—(d) Effective January 1, 1933, where cars are equipped with platform safety chains, same shall be located as follows: When facing end of car, the chain fitted with hook shall be on the left-hand side, and the chain fitted with eye on the right-hand side.

Passenger Rule 7—The committee recommends the addition of a new fifth sentence to Section (j) of this rule, to read as follows:

Proposed Form—Triple valve may be cleaned separately if defective within time limit, including separate stenciling.

The committee also recommends that a new note be added to Section (j), to read as follows:

Proposed Form—Note. When U-12-BC type of U. C. control valve is removed, it should be replaced in kind, or, if replaced by U-12 or U-12-B valve, proper credit must be allowed car owner as outlined in notes following Item 20-C of Passenger Rule 21. In the substitution of the U-12-BC valve for defective U-12 or U-12-B valve, car owner is not responsible for the betterment.

Passenger Rule 8—The committee recommends that Section (g) of this rule be modified to include metallic steam-heat connector since these connectors should receive the same protection as missing steam hose.

Passenger Rule 9—The committee recommends that a new note be added to Section (d) of this rule, to read as follows:

Proposed Form—Note. For terminal lubrication on passenger equipment cars in through line service, an arbitrary allowance of fifty cents (labor and material) per car, shall be charged.

Report of Sub-Committee on Cost of Car-Repair Billing

An analysis of 1,559 monthly incoming bills showed that the percentage of labor to material, as appearing in these bills, fluctuated from approximately 41 per cent to 72 per cent, while the weighted average percentage of labor to material in all such bills was 51.7 per cent.

The theory is that to the material charge for straight repairs appearing in a bill, the weighted average of 51.7 per cent should be added as representing labor. It was decided by the sub-committee that such an arrangement would not work out equitably for all concerned.

The question of including bills rendered on authority of defect cards on a similar basis was also considered but on account of the exceptionally wide range of percentage labor to material it was decided the proposed plan would be highly inequitable and therefore impracticable of application.

From an analysis of the accumulated data covering this subject, the sub-committee is unanimously of the opinion that the plan for adding an arbitrary percentage to material costs to cover labor, in lieu of the present detailed labor charges, should be abandoned.

The report of the Arbitration Committee was signed by T. W. Demarest (chairman), general superintendent motive power, P. R. R.; L. Richardson, chief mechanical officer, B. & M.; F. W. Brazier, assistant to general superintendent motive power and rolling stock, N. Y. C.; J. J. Hennessey, assistant superintendent car department, C. M., St. P. & P.; G. E. Smart, chief of car equipment, C. P. R.; C. T. Ripley, chief mechanical engineer, A., T. & S. F.; G. F. Laughlin, general superintendent, Armour Car Lines; Thos. Beaghen, Jr., superintendent car maintenance, Mexican Petroleum Corporation.

Discussion.—A somewhat extended discussion followed the reading of the report by Chairman Demarest. In connection with the welding of car axles, one of the members stated that his road has followed the general practice of building up worn collars by welding for several years, and asked if any failures as a result of this method of reclaiming car axles have occurred on any roads. Apparently no such failures are recorded, but the opinion was expressed that in the interests of safety all welding of every description on car axles should be eliminated, and it was stated that reforging to the next smaller journal diameter with the formation of complete new collars and standard journal lengths not only is practicable from the point of view of economy, but refines and anneals the metal, making it superior to that in the new axle.

The question of cross-billing and the exchange of "wooden money" as a result of present methods of billing for repairs to foreign equipment came in for a lengthy discussion. The cost of this billing on American railroads was stated to be in the neighborhood of $3,500,000. The feasibility of eliminating billing entirely has been considered by the Arbitration Committee and prominent executives in the Mechanical Division for years, the stumbling block being what to do in the case of privately-owned equipment. The suggestion was advanced that in case it proves impracticable to do away with billing entirely, a large proportion of the work can be eliminated by reducing the number of items for which bills can be rendered. The idea was also advanced that possibly central or regional billing bureaus, provided with the latest equipment and methods, could be established as clearing houses to eliminate individual road billing.

In closing, Chairman Demarest invited an informal expression of opinion regarding the four following questions:

Are you in favor of the entire elimination of car-repair billing?—Considered impractical.

Do you favor a continuation of present billing methods, modified so as to reduce the volume of work?—Approved.

Should the number of car repair billing items chargeable to the owner be reduced?—Generally approved.

Should the Arbitration Committee give further consideration to the possibilities of developing central or regional bureaus, under the supervision of the American Railway Association, to serve as clearing houses and eliminate individual road billing?—Approved.

The report was accepted and ordered submitted to letter ballot.

Prices for Labor and Material

Rule 101—All miscellaneous material prices in Rule 101 were rechecked as of March 1, quotations from purchasing agents of eleven railroads, representing 39 per cent of total freight-car ownership in the United States and Canada, indicating a general downward trend in material markets.

New Item 54-B is recommended to cover credit for scrap triple valves. New Items 124-A to 124-J are recommended, covering charges and credits for type E coupler and parts thereof. New Item 200 is recommended, covering the 200,000-lb. capacity axle. Two new items have been added and one item revised in table of friction-draft-gear prices, to cover additional types of such gears. The prices of a number of gears shown in this table have also been revised.

Investigation by your committee of weights used for new and scrap wheels and axles in setting up A. R. A. material prices, developed some modifications necessary; and the new average weights obtained as a result of this investigation have been used in setting up new allowances for these items in both freight-car Rule 101 and passenger Rule 22.

Investigation has been conducted by your committee in conjunction with the Purchases and Stores Division, as to correctness of percentages for store expense and interest on investment used in making up material prices for the Interchange Rules. The precentages being used for this purpose are correct and no change is recommended at this time.

No change is warranted at this time in the hourly labor allowances.

Rule 107—Item 159 is eliminated, account confliction with Rule 108.

Rule 111—Item 4 is modified, by eliminating the words "retaining valve," to clarify the intent.

Rule 112—Recommendations are made in Rule 112 respecting reproduction pound prices of new freight-train cars of all classes in order that Supplement of August 1, 1931, may reflect 1930 costs in lieu of 1929 figures shown in present Code. The prices submitted for your approval will be found to follow the trend which occurred in the 1930 market covering total new equipment purchases as compared to 1929. Pound prices for refrigerator and tank cars are based on figures furnished by representative roads and private lines in the United States and Canada. Prices for all other equipment represent the average selling prices set up by the President's Conference Committee, which secured quotations on total output of several large U. S. car manufacturers.

Passenger Rule 21—Item 17-A is eliminated, account covered by new Items 38-D and 38-E of passenger Rule 22. In order that car owner may be properly compensated in substitution of U-12-B for U-12-BC type of control valve, your committee is recommending new last note under Item 20-C to provide proper credit in such cases. New Item 20-H is added to provide charge for separate cleaning of safety valves.

Passenger Rule 22—Changes in material prices in a number of items under this rule are recommended, based on quotations as of March 1 from the purchasing agents of eleven representative railroads. Item 35 covering coach oil is eliminated and Item 34 modified to cover all lubricating oil. New Items 38-A to 38-E, inclusive, are recommended to provide charges and credits for metallic steam connectors and parts thereof.

[The changes recommended in the existing rules are shown in detail in tables which are not included here.—EDITOR.]

The report was signed by A. E. Calkins (chairman), superintendent rolling stock, N. Y. C.; Ira Everett, consulting master car builder, L. V.; F. J. Dodds, general car inspector, A. T. & S. F.; P. Kass, superintendent car department, C. R. I. & P.; O. A. Wallace, supervisor car repairs, A. C. L.; T. J. Boring, general foreman, M. C. B. Clearing House, Penna.; H. H. Harvey, general car foreman, C. B. & Q.; H. H. Boyd, assistant chief motive power and rolling stock, C. P. R.; A. E. Smith, vice-president, Union Tank Car Company; A. H. Gaebler, superintendent car department, General American Transportation System, Inc.

Action.—The report was accepted.

Automotive Rolling Stock

The Automotive Rolling Stock Committee devoted its efforts for the year 1930-1931 to activities which could be handled by correspondence. Notwithstanding certain limitations extensive data were collected on three subjects of interest to the railroads operating rail motor cars, as follows: 1. Rail motor cars put in service since 1923; 2. Depreciation of rail motor cars and equipment; 3. Crank-case oil reclamation.

Questionnaires were sent out and replies received from 115 railroads. Among these 115, sixty-two operate rail motor cars and include practically all of the principal operators of such equipment in North America. Hence, the information obtained can be considered quite representative.

Rail Motor Cars Put in Service Since 1923—The committee presented a table giving in considerable detail information concerning all of the rail motor cars which have been placed in service since 1923. Up to and including 1930 the total number of such cars placed in service was 730. The table shows the cars by ownership and gives the year placed in service; the type and capacity of the power plant; the overall length of the car; the lengths of the engine, baggage, mail and passenger compartments; the seating capacity, and weight.

Depreciation—Three questions were submitted to the railroads requesting information on depreciation practices.

Of the 62 railroads reporting on their rail motor cars, 60 stated such cars were depreciated. One railroad reported no established rate for depreciation and one railroad reported no depreciation of rail motor cars. Of the 60 railroads, 27 reported using an over-all depreciation rate covering both car body and motive-power apparatus. Such over-all rate varied from two per cent to fifteen per cent with a mean rate of about 6.5 per cent. The remaining 33 railroads reported different rates applied to car body and motive-power apparatus. Car body depreciation rate varied from 1.8 per cent to six per cent with a mean rate of about four per cent. Motive power apparatus depreciation rate varied from 3.288 per cent to 20 per cent with a mean rate of about 10 per cent. There was a disposition on the part of a few railroads to apply depreciation rates differently or in more detail.

Crank-Case Oil Reclamation—Included in the questionnaire sent out to the railroads were seven questions relative to the reclamation of crank-case oil. Of the railroads questioned 25 reported reclaiming crank-case oil. Two railroads stated that such reclamation was performed by an outside agency. The remainder reported no reclamation of crank-case oil. A variety of makes and types of apparatus was used for such reclamation.

Among the 24 railroads reporting definite cost per gallon for reclamation, the minimum cost was 8.4 cents per gallon and the maximum 24 cents, with a mean of about 15.5 cents per gallon. This cost is quite significant as it indicates the substantial saving over the cost of new oil which can be realized by the reclamation of used crank-case oil.

The consensus of opinion relative to comparison of reclaimed oil with new was that the former compared about equally well with new oil.

The report was signed by P. H. Hatch (chairman) engineer of automotive equipment, N. Y., N. H. & H.; H. F. Finnemore, assistant electrical engineer, C. N. R.; B. N. Lewis, mechanical superintendent, M., St. P. & S. S. M.; F. K. Fildes, assistant engineer, P. R. R.; W. J. Wilson, chief motor-car draftsman, U. P.; J. R. Jackson, engineer of tests, M. P., and E. Wannamaker, electrical engineer, C., R. I. & P.

Action.—The report was accepted.

Report of Wheel Committee

The Committee recommends that the specifications, adopted as standard in 1917 and revised 1926, be again revised and submitted to letter ballot as standard practice as follows:

Section 2, paragraph (c)—The depth of clear white iron shall not be less than ½ in. and shall not exceed 1⅛ in. at the throat or 1¼ in. at the center line of tread. The bending of clear white iron with the grey iron behind it shall be without any distinct line of demarcation. The depth of clear white iron shall not vary more than ¼ in. around the tread in any one plane in the same wheel. These limits apply to all weights of wheels.

Section 4, paragraph (b)—Insert after second sentence—"The plane of the flange when gaged on the face of ⅝ in. above the base line of tread, shall not vary more than 1/16 in."

Section 5, paragraph (d)—If test wheel cracks in the plate with nine blows or less, it will be considered as having failed.

Section 5, Table II—Increase height of drop for 850 lb. wheel to 15 ft.

The committee recommends that the present standard specification for chilled iron wheels, adopted 1917 and revised 1926, be again revised in accordance with the above recommendations and submitted to letter ballot for adoption as standard practice.

Foundry Practice Requirements

14. Chill test block—(a) A chill test block must be taken at least once out of every ten wheels poured. The size of the test bar shall be 1½ in. wide, 3 in. to 4 in. thick and 6½ in. to 8 in. long, 1½ in. face to be placed against the chiller.

(b) The depth of chill measurement shall be recorded in sixteenths.

15. Analysis test block—(a) A test block 3 in. by 3 in. minimum section and 4½ in. minimum in length shall be cast, preferably in dry sand, one test bar poured from the first and one from the last tap, and at least two bars from intermediate parts of the heat.

(b) The drillings shall be obtained from the end of the test block. The first drillings shall be discarded, the drilling continued, and the resultant chips, etc., dumped from the hole and taken for sample, or the block may be broken and the drillings taken at the point of fracture.

(c) An analysis may be made for each block and recorded, or, at the option of the manufacturer, the samples may be mixed of equal quantities, but at least one analysis shall be made to represent the day's heat.

27. Drop test—In addition to the requirements b and c of paragraph 5 above, the Manufacturers' "Standard Practice for Foundries" specifies: "In addition to the above, care should be taken to see that the tup falls free in the guides and that the supporting bosses are solidly anchored to the large base plate and so located that only the back of the flange rests on them. The space between the hub of the wheel and the base plate shall be kept free from sand and broken pieces of wheel."

"The tup shall weigh 250 lb. when first placed in service, and shall be removed when found to weigh less than 247 lb."

"The drop tests shall be to destruction. (After 36 blows the height of drop may be increased or big drop used.)"

28. Thermal tests—In addition to the specification requirements, the Manufacturers' "Standard Practice for Foundries" specifies: "The wheel shall be observed for at least 10 minutes after the rim is poured to note and record any structural failure."

30. Tape lines—In addition to the specification requirements, the manufacturers' "Standard Practice for Foundries" specifies: "Tape lines should be checked daily on a car wheel used as a master. This wheel shall be an exact tape 3 as checked by the Association Master Tape Line. The exact weight of the master wheel should also be determined and the correct weight stamped on same, so that it may be used for checking the scales used for weighing the new wheels."

Chilled iron wheels—One of the changes recommended is the addition of a clause restricting variation in plane of the flange to 1/16 in. It is not the intention to suggest the checking of each wheel by inspectors to detect this defect but the clause should be inserted as protection in case the condition is encountered at any particular wheel foundry. Generally, warpage is discovered in the wheel plant or when the wheels are chucked in the boring mill. Paragraph 137 of the Wheel and Axle Manual will be amplified so as to provide a check on warpage when the manual is revised.

The attention of the committee has been directed to the condition of some of the second-hand wheels applied to foreign equipment. A considerable number of wheels are reported as out of round and thin chill. The committee will cooperate with the Arbitration Committee in an investigation of this question.

Worn-thru chill cast-iron wheels—Considerable difficulty has been arising on certain railroads, due to breakage of cast iron wheels, which have worn through the chill. It appears that a considerable number of wheels are being permitted to run and in some cases wheels are possibly being applied to cars which have this worn-through chill condition. Inspectors should be warned to keep a close watch for this defect.

The committee called attention to the importance of the new proposed Rule 83, which prohibits the application of wheels of weights of less than 650 lb. and 700 lb. nominal weight, regardless of date cast. The light-weight wheels are not sufficiently strong to meet modern operating conditions and it is felt that it is a mistake to apply them to any cars. Considerable numbers of such wheels are accumulated on roads where old equipment is being scrapped. The only safe usage for such wheels is in work equipment. The Wheel Committee, therefore, recommends that no extension in date be granted for this rule and that it should become effective January 1, 1932.

The vertical-flange height limit of ⅞ in. for chilled-iron wheels under cars of 80,000-lb. capacity and over should be modified for the standard reinforced flange, single-plate wheels. The committee is in touch with a test now under observation to confirm the practicability of this change and expect to have ample information at hand to support a further recommendation in the report for 1932.

A general improvement in wheel-mounting practice is reported since the introduction of the Wheel and Axle Manual. It is apparent, however, that some shops are not as yet equipped with standard mounting gages.

Removal of Wheels Which Have Not Reached Condemning Limits

The 1930 annual report of the committee called attention to the loss occasioned by delays to loaded equipment due to condemning wheels close to, or even at, the condemning limits. A list of the defects which the committee considers should be permitted to remain in service until the loaded car reaches destination, follows:

Chilled iron—Flange worn, vertical flange, brake burned, tread worn hollow, nominal weights less than 650, 700 and 750 lb., and nominal weights less than 650 and 700 lb.

Wrought steel—Flange worn thin, vertical flange, thermal cracks, high flange, and tread worn hollow.

The Arbitration Committee has been advised of our suggestion with the thought that a rule might be incorporated into the interchange rules to better the present situation.

Worn-Through Chill—The committee has referred to the worn-through chill defect from time to time in previous annual reports and plans to investigate this defect further this year. The number of wheels reported as worn-through chill varies considerably on different railroads and it is apparent that the rule is being abused at some points. On the other hand some wheel shops do not seem to inspect second-hand wheels as closely as is desirable and some out-of-round and thin-chill wheels are applied and removed within a comparatively short period. The committee is arranging to have some wheels of this type accumulated for examination and it is hoped that a gage may be developed which will aid in better classification of this defect.

Brake burn in cast-iron wheels and thermal checks in wrought-steel-tired and cast-steel wheels—Some confusion is reported in connection with a distinction between brake burn in cast-iron wheels and thermal checks in wrought-steel, steel-tired and cast-steel wheels. It is suggested that the Arbitration Committee transfer the reference to cast steel wheels from the first paragraphs of Rule 75 (P.C.7) referring to brake burn, to the second paragraph of Rule 75 referring to thermal checks. The development of this defect is similar in cast steel and wrought steel and steel-tired wheels and should not be classified or treated the same as brake burn in cast-iron wheels.

Rim thickness for cast-steel wheels—The committee has been requested to recommend a condemning limit for rim thickness of cast-steel wheels. This has been governed heretofore by the use of cast-iron wheel gages but it has developed that cast-steel wheels may be turned under certain conditions. This practice would result in a reduction in the rim thickness and limits should be established to insure against the application of thin-rim wheels in service. The committee is not prepared to make a final recommendation in this report but suggests that the limit through the throat of 1⅛ in. for freight and 1⅜ in. for passenger service, established for wrought-steel wheels in Fig. 4, Page 258, of the interchange rules, should be considered as minimum condemning limits for cast-steel wheels until the committee has had an opportunity to conduct tests and make a final recommendation.

The report is signed by A. Knapp (chairman), inspecting engineer, N. Y. C.; C. T. Ripley, chief mechanical engineer, A. T. & S. F.; O. C. Cromwell, assistant to chief of motive power and equipment, B. & O.; H. W. Jones, general superintendent of motive power, central region, Penna.; H. W. Coddington, engineer of tests, N. & W.; J. Matthes, chief car inspector, Wabash; C. Petran, supervisor of tools and machinery, C. M. St. P. & P., and A. M. Johnsen, engineer of tests, Pullman Company.

Action.—The report was accepted.

Report on Tank Cars

During the year the committee considered approximately 125 dockets and applications for approval of design, covering 1518 cars, of which 1155 were Class I.C.C.—103.

Forge Welding—During the year question was raised as to whether certain methods of forge welding fully met the intent of the specifications for class 105 cars. The tank car committee have under way at the present time a comprehensive series of tests of welded containers made by different methods of forge welding.

Dome Closures for Class I. C. C. 104A Cars—During the year the committee started some studies of the various designs of dome closures used on Class 104A cars, with a view to mak-

ing certain recommendations which will tend to standardize these closures, and at the same time not unduly restrict development of the art. It is hoped to complete this work during the coming year.

During the past year the chief inspector of the Bureau of Explosives proposed certain revisions in the regulations which would make safer the transportation of inflammable liquids having a vapor pressure exceeding 16 lb. absolute. The committee concurred in Colonel Dunn's recommendation, and this has made it necessary to do considerable work in connection with checking over designs of dome closures proposed to replace generally the present screw type cover, and which would meet the new regulations.

Reversible Placard Holders on Tank Cars—For some time there has been discussion about the requirements for placard holders on tank cars. The committee now presents a design, which is free from patents and seems to meet fully all of the requirements of a reversible placard holder. The committee recommends that on and after January 1, 1932, all tanks, which are applied to new underframes, shall be provided with permanent metal placard holders at least equal to this design, and that on all cars receiving general repairs these, or equal metal placard holders be applied. The particularly desirable feature of the arrangement is that the cards are easily applied without the use of tacks, and it is almost impossible to lose them. The committee recommends that this proposed rule, and the drawing, be submitted to letter ballot for action by the association.

Specifications for Class A. R. A. 203 Cars.—When the tank car specifications were submitted to letter ballot last year, it was thought unnecessary to provide a separate specification for Class 203 Cars. It was concluded later that the 203 specification in effect should be included, and the following note was inserted in the specifications for tank cars to cover the 203 design:

> "Tank Cars required for the transportation of commodities not covered by the Regulations for the transportation by rail of explosives and other dangerous articles by freight are required to be built in accordance with I. C. C. Shipping Container Specification 103 but may be equipped with approved appurtenances or appliances necessary to the transportation of such commodities in tank cars.
>
> "All tanks so built shall be stenciled A. R. A.—203 ......only. The blank to specify the particular commodity requiring the special appurtenances or appliances in question."

Weight of Loaded Tank Cars at Rail.—During the year the committee has had one or two cases in which, due to later deciding to handle a heavier commodity in a tank car than that for which it was designed, it was found that the trucks would be overloaded. The heaviest commodity which will ever be handled in these cars should be used in determining the total weight at rail so that a suitable capacity truck will be used. It is not considered a safe practice to load tank cars less than shell-full.

New Developments.—During the year there have been several rather special types of cars built, requiring special material or treatment to prevent either contamination of the article carried or rapid deterioration of the tank structure itself. There may be mentioned the following:

1—6,500-gal. tank with lead lining.
3—40-ton, 3,000-gal., Class ICC-105A300 unlagged cars for transportation of ethyl fluid.
1—40-ton, 6,000-gal., Class ICC-103-B insulated tank car for transportation of formaldehyde.
1—40-ton, 5,000-gal., Class ICC-103, five compartment car for transportation of petroleum products.
4—100-ton, 12,000-gal., Class ICC-103-A cars for transportation of sulphuric acid.
1—Ethyl fluid tank car for transportation of ethyl compound.
2—Three-plate aluminum, Class ARA-201A35, tank cars for transportation of glacial acetic acid and formaldehyde.
3—8,000-gal., nickel-clad tank cars for transportation of iron-free caustic soda.
4—8,000-gal. double-wall tank cars with stainless-steel inner tanks.

Specification 107 Helium Cars.—This specification is in the process of revision, looking toward possibly three specifications, one for thick-walled vessels (walls 2½ in. and over) one for thinned-walled vessels (walls less than 2½ in.) and one for autogenously welded construction.

The report was signed by G. S. Goodwin (chairman), assistant to general superintendent motive power, C. R. I. & P.; A. G. Trumbull, chief mechanical engineer, C. & O.; George McCormick, general superintendent motive power, S. P.; F. A. Isaacson, engineer car construction, A. T. & S. F.; W. C. Lindner, chief car inspector, P. R. R.; G. A. Young, head, school of mechanical engineering, Purdue University; A. E. Smith, vice-president, Union Tank Car Company; T. Beaghen, Jr., superintendent car maintenance, Mexican Petroleum Corporation; F. G. Lister, assistant superintendent motive power, St. L. S. F.; G. E. Tiley, supervisor tank car equipment, General Chemical Company; C. C. Meadows, Tidal Refining Company.

Action.—The report was accepted and referred to letter ballot.

Committee on Loading Rules

As a result of the investigations, your Committee submits the following recommendations for changes and additions in the rules and figures for your approval and submission to Letter Ballot for adoption by the Association.

[The committee submitted a set of instructions prohibiting the use of temporary advertisements on cars and specifying the size and character of routing cards, commodity cards, special placards, symbol and A. R. A. cards, and special cards required by federal or state governments, and regulations concerning their use, which it proposes for inclusion in the Loading Rules because of requests from several shippers. In some cases the shippers have supplied themselves with a card which did not comply with Interchange Rule 36, and when their attention was called to this fact they stated that if they had known this they would have complied with the rule.—EDITOR].

General Rules for Loading Materials

Rule 4 Proposed Form—Cars *shall* be in such condition that the trucks can curve freely and the *average* clearance per side-bearing per truck must not exceed 5/16 in., and must not be less than ⅛ in.

Rule 8—Add the following sentence to Paragraph (b): *"For loads carried as single loads, overhanging one, or both ends, the weight limits shown in Rule 23 will govern."*

This rule has been modified at the request of one of the large steel shippers to provide cross reference to Rule 23, because of Rule 8 requiring the weighing of the load in case of doubt, while Rule 23 sets forth specific allowable weights.

Rule 12—Add the following sentence to Paragraph (a): *"If the length of the material is such that it cannot be loaded without dropping the end gate, necessary blocking must be provided in order to clear end gate."*

Rule 13—Add. "Note 2. *Shipments of long steel, which are liable to sag and take a permanent set due to this cause must have sufficient bearing-pieces applied to prevent sagging."*

Rule 21—Add the following sentence: *"For method of securing operating mechanism of Rotary Types D and E couplers where coupler spacing blocks are required. See Figs. 3, 4 and 4-A."*

Rule 23—Proposed Form: Maximum Weight.—Single Loads Overhanging One End or Both Ends of Car—In *such* loading *the following weight limitations shall govern.*

Note 1: Shipments of long steel, which are liable to sag and take a permanent set due to this cause, must have sufficient bearing-pieces applied to prevent sagging.

Rule 24—Eliminate the note under this rule.

Group II—Rules Governing the Loading of Structural Material, Plates, Billets, Castings, Wheels, Pipes, Etc.

Rules 223, 224 and 224-A—[The committee recommends that the rules and figures be modified to take care of loading of light girders that may become damaged when loaded on more than one car. Also to correspond to more modern methods of loading. Figs. 58, 59 and 60 (not shown here) have been revised and an additional list of materials added, to correspond to the proposed changes in Rules 223, 224 and 224-A.—EDITOR].

Rule 228—It is proposed to eliminate Note 1 from this rule because it conflicts with Rule 30, which permits the loading of gondola cars.

Rule 239—Proposed Form: Paragraph 1. Rails, bar iron, channels, angles, etc., should, whenever possible, be loaded on single gondola cars. *If the length of material is such that it cannot be loaded without dropping the end gates, suitable blocking must be provided to clear the end gates.* If the length of material is such that it can be loaded inside of end gates, they must be raised and securely fastened. [The remainder of paragraph 1 is unchanged—EDITOR].

Rule 246—[The proposed form of this rule is worded to permit loading turntables on two or more cars, forming *triple or quadruple* loads as well as twin loads.—EDITOR].

Rule 249—[The proposed form of this rule permits the loading of pipe from 24 in. to 30 in. in diameter, inclusive.

The number of stakes for loading the pipe at various heights above the car sides remains unchanged although the number used in each case is specified—*"per pile."* Explicit instructions

as to methods of wiring, use of chock blocks, height of stakes, etc., is also given in the proposed form of the rule. It is recommended that Figs. 78 and 79 be eliminated because the requirements covered by them are now included in Fig. 80. The latter is modified and made to include pipe 24 in. to 30 in. in diameter, inclusive.—EDITOR].

Rule 250—It is recommended that this rule be eliminated because all requirements are now included in Rule 249.

Rule 250-A—[The Rule has been modified to state that "intermediate tie wires or bands *"shall be located on top of first tier above car sides"* instead of "as close to the top of the car sides as practicable, but not over 18 in. above top of same," as the present rule reads. The proposed form also states that "additional intermediate tie wires or bands must be applied to stakes at *not more than 30-in.* intervals above the first intermediate tie wire or band" instead of 24-in. as stated in the present rule. Both proposed changes are to be included in both the third and fourth paragraphs. The rule was modified to provide a more suitable location for the intermediate wires.—EDITOR].

Rule 250-B—This rule has been modified to include pipe 30 in. in diameter and to eliminate definite base line of lower tier in upper unit which has been found safe and practicable.

Rule 251—[This rule has been modified to include pipe from 24 in. to 30 in. in diameter, inclusive, which has been found to be safe and practicable. Pipe 12 in. or less also included, thereby, eliminating Rule 258. The reference to Rule 249 for wiring and staking is replaced by complete instructions, in this rule. The use of Saplings is prohibited. Intermediate wire for loads over 3 ft. high has been found necessary and is included for safety.—EDITOR].

Rule 251-A—Proposed Form: Flat and Gondola Cars: Wrought iron pipe *more than 30 in.* in diameter must be loaded in accordance with Figs. 81-E, 81-E-I, 81-F, 81-G, 81-H and 81-I.

When loaded *on flat cars as per* Figs. 81-G, *81-H and 81-I, the side blocking must be backed up with 4-in. by 5-in. stakes fitted into stake pockets, and where possible must extend 14 in. above top of car floor. Where width of load will not permit this, the height of stakes must be sufficient to come in contact with pipe. Where diameter of pipe is such that blocking of sizes specified in Figs 81-G, 81-H and 81-I cannot be used, the blocks must be wedge shaped and side against stakes to be as high as possible.*

Pipe loaded *as per* Fig. 81-G, *must be secured with two rods ⅝ in. in diameter,* or bands of equal strength, with threaded ends, may be substituted with two high tensile strength bands not less than 2 in. in width, or wires having a total ultimate tensile strength of not less than 7,200 lb.

Pipe loaded as per Fig. 81-H and 81-I, secured with three rods ¾ in. in diameter, or bands of equal strength, with threaded ends, may be substituted with six high tensile strength bands not less than 2 in. in width, or wires having a total ultimate tensile strength of not less than 15,000 lb. *Where intermediate cradle blocks are used and rivet holes are available, center tie rod or equivalent, may be omitted, in which case the ends of the pipe must be bolted together. Where more than four high tensile strength bands, or wires, are required per pile, the additional bands, or wires, must be used to tie piles into a unit.*

The number of pieces of pipe in each tier and number of tiers, when loaded in accordance with Figs. 81-H and 81-I, shall be governed by the diameter of pipe.

When not loaded in pyramidal form each pipe must be placed directly in line with the one underneath.

[The next paragraph is the same as in present Rules.—EDITOR].

Note: Riveted pipe that may be damaged by coming in contact with each other must have filler pieces not less than 1 in. by 4 in. of sufficient length, and placed so as to protect pipe from damage by rivet heads.

This rule was modified to more clearly define its intent.

Rule 251-B—Proposed Form: Loading of Wrapped Pipe on Gondola Cars. Fig. 80-C: For pipe less than 25 ft. in length, three pairs of stakes and three skids must be used. For pipe more than 25 ft. in length four pairs of stakes and four skids must be used. When height of load exceeds 3 ft. above car sides, one pair of stakes must be added. Stakes shall not be more than 5 ft. from ends of pipe, and intermediate stake, or stakes, shall be equally spaced between the two end stakes.

Hardwood, 2 in. by 6 in. skids No. 2, shall be about 3 in. shorter than inside width of car. Bands No. 1, shall consist of high tensile strength steel, not less than 2 in. wide, having an ultimate tensile strength of not less than 7,200 lb. They shall be lightly secured to bottom of skids with staples, and long enough to pass around the load so that ends will overlap on top of load.

Hardwood, 4 in. by 4-in. stakes No. 3 must extend from top of skids to top of load, and they shall be placed so that half of their thickness projects beyond the ends of skids. Band No. 1, must be secured to the outside of stakes with suitable metal straps No. 6, so as to permit free vertical movement of the former. Metal straps No. 9, shall be securely attached to outside of stakes and in line with angles on top of car sides, so constructed as to prevent the shearing of bands No. 1. Wrapped excelsior padding No. 4 shall be secured to inside faces of stakes with tie wires No. 5, and padding of baled excelsior must also be placed on top of skids. To keep stakes away from side of car and in proper position while loading, place block No. 8 between stake and side of car near top, and place block No. 7 at same location near bottom. These blocks should be removed after they have served their purpose so that load is relatively free to adjust itself without causing damage to the wrapping on the pipe.

After load has been finished, place sufficient excelsior padding on top of it to prevent damage to pipe wrapping, also cut off the stakes so that the inner sides of same are flush with top of load and beveled towards outer side to permit snug fitting of, and preventing sharp bends in bands. Band No. 1, shall then be placed over the pads on top of load, and they must be drawn equally taut with overlapping ends substantially sealed or welded together.

Note: All excelsior must be entirely enclosed with heavy wrapping paper.

It is recommended that the above rule be included in the Loading Rules to take care of a new condition in the shipment of pipe. Experimental shipments have proven this method safe and satisfactory.

It is recommended that Figs. 81-A, 81-C and 81-D. be eliminated from the Loading Rules because these methods of loading are now taken care of in Figs. 80, 81-G, 81-H and 81-I.

Rule 255—The marginal reference was modified as it should be confined to cast iron pipe.

Rule 258—It is recommended to eliminate this rule because all of its requirements are now taken care of in Rule 251.

Group III—Rules Governing the Loading of Mining Cars, Engines, Boiler Shells, Machinery, Derricks and Similar Commodities

Rule 302—This rule was modified at the request of one of the large tank shippers to define more clearly when end blocking was to be applied. This was done by separating paragraph three into two paragraphs and adding a definite statement to cover all tanks over eight feet in diameter.

Rule 304—[It is recommended that the heading to this rule read: *"Loading of Engines, Tractors, Compressors and Similar Machines, on their own wheels, also Tractors, Wagons, Etc., of the Crawler Type."* Also that general Rule No. 6 be added, which must be observed in addition to the ones specified in the first paragraph of the present rule. This modification is recommended on account of the heavy blocking provided for in Figs. 102 and 103 not being required on tractors, etc.—EDITOR.]

Rule 305—[It is recommended that the following sentence be inserted as the second sentence of the rule: *"Compressors weighing over 8,000 lb. may be loaded as per Fig. 105 and combined harvesters must be loaded as per Fig. 105-F."* This sentence is added to clarify the methods of loading compressors and combined harvesters.—EDITOR.]

Rule 305-A—[It is recommended that the phrase *"weighing 25,000 lb. or less"* be inserted in the first sentence of the rule, specifying the weight of tractors, wagons and similar machines to clarify the rule. It has been recommended to modify the bracing requirements at the rear of the machines shown in Fig. 103-A to provide a bearing piece between the uprights and floor of the car. It is proposed to change the headings to Figs. 104, 105, 105-A, 105-B, 105-C, 105-D, 105-E to state that the equipment shown shall be loaded *lengthwise on the cars.* The wording of Figs. 104 and 105 to coincide with changes in Rules 304 and 305 and the wording of the others to coincide with changes in Rule 305 only. Fig. 105-F is added, new, to take care of loading combined harvesters weighing over 8,000 lb. The word "Engines" has been left out of the heading to Figs. 106 and 106-A to coincide with the change in Rule 305. None of the figures mentioned are included here.—EDITOR.]

Rule 306—The second sentence of Section (e), second paragraph, is changed to read: *Alternate methods may be used by securing the body portion to the crawler structure with two anchors at front and two anchors at rear, or two anchors at outer end of boom, direct to car body, and two anchors at rear of body portion to crawler structure. When these alternatives are used, the machine must be secured to the car with cables or rods of sufficient strength to prevent excess vertical*

motion, except when loaded as shown in drawing Fig. 103-C.

This rule has been modified to take care of alternate methods of loading.

As an additional safety measure the following sentence is added to the note at the end of Rule 306: *"Propelling mechanism must be thrown out of gear and secured in that position, or disconnected."*

Group IV—Rules Governing the Loading of Concrete Culvert Pipe, Brick, Stone, Building Tile and Similar Products

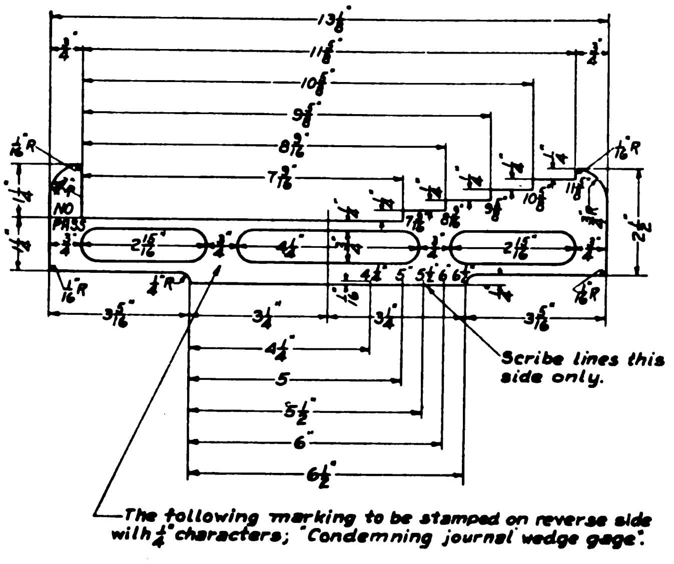
Rules 406, 407 and 408—[As an additional safety measure, in all three of these rules, where mention is made of two stakes being used for securing the load, it is proposed to make them read: " . . . and two pairs of side stakes must be used *per pile 10 ft. or less in length, and three pairs of stakes must be used per pile exceeding 10 ft. in length,* in addition, etc." The remaining parts of all these rules with the exception of the above italicized portion, remain unchanged.—EDITOR.]

The report was signed by Samuel Lynn (chairman), superintendent rolling stock, P. & L. E.; R. H. Dyer, general car inspector, N. & W.; E. J. Robertson, superintendent car department, M. St. P. & Sault Ste. Marie; G. R. Lovejoy, master mechanic, Detroit Terminal Railway; T. O. Sechrist, assistant superintendent Machinery, L. & N.; C. J. Nelson, chief inspector, Chicago Car Interchange Bureau; R. B. Rashbridge, superintendent car department, Reading; W. B. Moir, chief car inspector, Pennsylvania; J. A. Deppe, assistant superintendent car department, C. M. St. P. & P.

Action.—The report was accepted and referred to letter ballot.

Lubrication of Cars and Locomotives

In its 1931 report the Committee on Lubrication of Cars and Locomotives urged that serious attention be given to eliminating the use of inferior grades of oil, which at low temperatures will congeal and cause packing to roll, thus



Condemning gage for journal bearing wedge

causing a hot box. The report called attention to tests which were now being conducted by a number of oil companies to determine satisfactory grades of car oil. During the coming year the committee expects to complete tests to determine the quality of waste best adapted for feeding oil to the journal and holding oil in suspension. Extensive tests are now in progress to determine whether it is practical to discontinue the use of the back roll.

The committee proposed the following definition of a hot box for adoption as recommended practice: "An overheated journal (commonly known as a hot box) is one that requires treatment or setting out of any car when such hot journal develops between originating point and point of destination of the car on carrying road, irrespective of class of train or point at which car is set out."

The report also contains a method for analysis of reclaimed waste and a journal-bearing-wedge condemning gage. It stated that there were still a number of railroads and private lines using inferior materials in packing of car-journal boxes, and were stenciling the cars to indicate that the box packing had been properly done.

The recommendations for reporting hot boxes, method for analysis of reclaimed waste and the journal-bearing-wedge condemning gage were proposed by the committee for adoption by letter ballot.

That part of the report pertaining to lubrication of locomotives showed progress in the work of the committee to secure further improvements in locomotive lubrication. The use of ⅛-in. perforations in perforated plates, instead of 3/16-in. proved satisfactory in warm climates but not altogether successful at temperatures below freezing. Service tests extending over a period of approximately 18 months on one road, where it is necessary to provide against extreme summer and winter temperatures, have shown that perforated plates with 3/16-in. perforations and follower plates with a spring tension of 75 lb. maximum and 70 lb. minimum at 1-in. height, provide a happy medium. Further tests of split driving-box brasses shown in the 1930 report of the committee reflect improved performance in reducing running temperatures and consequent reduction in the consumption of driving-journal compound on heavy power in fast service. A service test of mechanical lubrication of driving hubs, making use of heavy oil forced to the hubs with a mechanical force-feed lubricator showed good results. A heavy freight locomotive showed less than 7/16-in. wear on the hub liners after 40,000 miles.

A considerable portion of the report was devoted to engine-truck journal lubrication in connection with floating engine-truck bearings. Reports received by the committee show that mechanical force-feed lubrication has effected a substantial improvement in a reduction of the number of hot bearings. The committee also reported good performance of engine-truck and trailer hub lubrication with floating hub liners and grease applied under pressure through the hubs on engine trucks and through the box on the trailing trucks.

The report was signed by G. W. Ditmore (chairman) master car builder, D. & H.; H. W. Johnson, superintendent of motive power and rolling stock, M. & St. L.; P. Maddox, superintendent car department, C. & O.; T. O. Sechrist, assistant superintendent of machinery, L. & N.; A. J. Harner, lubrication engineer, U. P.; M. J. O'Connor, mechanical inspector, N. Y. C.; E. Von Bergen, general air brake, lubrication and car-heating engineer, I. C.; I. T. Burney, lubrication engineer, B. & M.; E. C. Cromwell, lubrication supervisor, B. & O.

Discussion.—The desirability of an A. R. A. gage to check distorted wedges when taken back in the shop and reset was emphasized, and Chairman Ditmore said that the committee would proceed with the development of such a gage during the coming year. A member stated that the most important work of the committee would be the development of specifications for a single oil which would meet both summer and winter conditions satisfactorily; that good results are being secured and that further study and progress should be made.

The extension of the period for repacking car journals on the repair tracks from nine months to 12 or more was suggested, the consensus being that such extensions should not be granted in the case of journal-box packing unless also granted for air-brake cleaning, in order that both of these operations can be performed at the same time. The question of extension of the time for periodic repacking of journal boxes and cleaning of air brakes was referred jointly to the Lubrication and the Brake Committees for a thorough study of all the various factors involved, and the development of recommendations to be submitted at next year's convention. The Lubrications Committee was also asked to amplify its definition of a hot box in order to make all details clear and understood.

The report was accepted and the recommendations referred to letter ballot.

Report on Couplers and Draft Gears

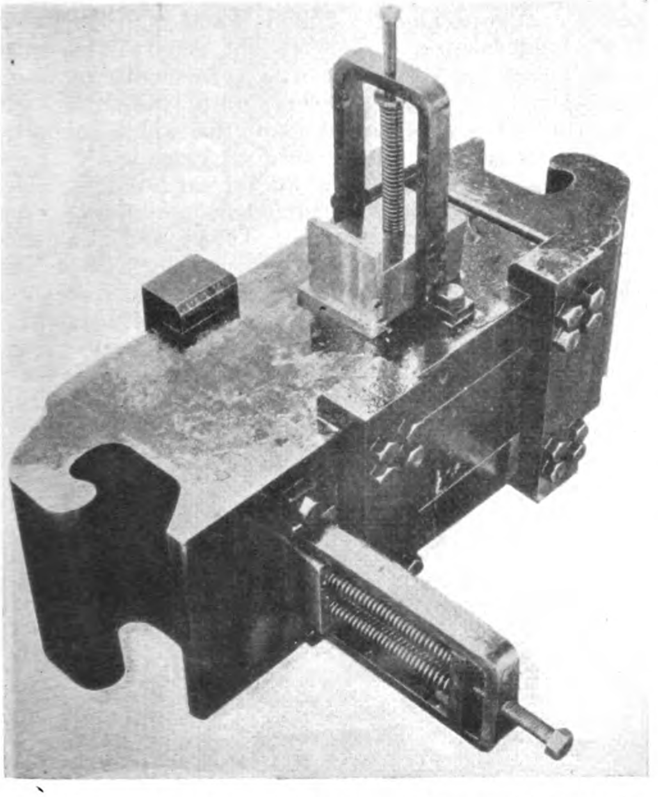
The Committee on Couplers and Draft Gears reported satisfactory results from its study of the operation of the Type-E coupler, and recommend that it be advanced from recommended practice to standard. It is recommended, however, that the Type-D coupler remain as a standard until the Type-E is generally introduced.

A number of designs of uncoupling rigging with the Type-E coupler were submitted by several manufacturers for tests. It was recommended that a type of rigging submitted by the McConway & Torley Company and a second type submitted by the National Malleable & Steel Castings Company be submitted to letter ballot for adoption as recommended practice.

During the year the committee observed the performance of rigid-shank couplers with horizontal attachments; Symington swivel-butt couplers with horizontal attachments, and rigid-shank couplers with vertical cast-steel swivel yokes. With the object of facilitating interchangeability of parts in couplers with swiveling features, the coupler manufacturers have agreed on the manufacture of one type of swivel-butt coupler; namely, the Symington design, which all are privileged to manufacture. This action on the part of the coupler manufacturers made it necessary to develop comparative data as to the strength of the parts involved. Static tests were made in the laboratories of the Buckeye Steel Castings Company and the National Malleable & Steel Castings Company, under the supervision of the committee, of the Type-E coupler, 6¼-in. by 8-in. rigid shank; Type-E coupler, 6¼-in. by 8-in. swivel shank; A.R.A. vertical-plane cast steel yoke; A.R.A. vertical-plane cast-steel swivel yoke; Type-E coupler, 6¼-in. by 8-in. rigid shank and vertical-plane cast-steel yokes, and Type-E coupler, 6¼-in. by 8-in. swivel shank and vertical-plane cast-steel swivel yoke.

Report of Sub-Committee on Draft Gears—The Sub-Committee on Draft Gears continued its car impact tests during the year and the conclusion was reached that, in order to determine the maximum permissible recoil, it will be necessary to conduct road tests. These tests will be made as soon as possible. The sub-committee recommended that Section 11 of the specifications be changed to read as follows:

"*Recoil*—A minimum percentage of recoil, consistent with freedom from sticking, is desirable. The recoil shall be measured and reported for each type of car tested, but this shall be only for the information of the purchaser and no car shall be rejected solely on account of high recoil until a definite limit is set."



Ball-impression dynamometer designed and built by the Pennsylvania to measure the force acting between two cars

This recommendation, together with supplementary-purchase specifications for improved draft gears for freight service, were recommended for submission to letter ballot for approval as standard.

The report concluded with recommendations that further tests of trains equipped with standard gears, selective-travel, the Alma gear and the Duryea car-cushioning device, be continued by the A.R.A. It also recommended to the manufacturers that attention be given to a solution of the difficulty of applying many types of draft gears owing to the necessity of compressing the friction elements in order to insert the gear in the standard pocket.

The report of the sub-committee on rigid-shank and swivel-butt couplers was presented by H. W. Coddington (chairman), and the report of the sub-committee on draft gears by H. W. Faus (chairman), engineer of tests, N. Y. C. The report of the main committee was signed by R. L. Kleine (chairman), assistant chief of motive power, Penna.; C. P. Van Gundy, engineer of tests, B. & O.; C. J. Scudder, superintendent of motive power and equipment, D., L. & W.; H. W. Coddington, engineer of tests, N. & W.; C. B. Young, general mechanical engineer, C. B. & Q.; Samuel Lynn, superintendent of rolling stock, P. & L. E.; J. P. Michael, chief mechanical engineer, C. & N. W., and C. T. Ripley, chief mechanical engineer, A. T. & S. F.

Discussion.—In answer to a question as to the advisability of advancing the type-E coupler from recommended practice to standard with a relatively limited amount of service experience, Chairman Kleine pointed out that the type-D coupler, since it was first applied in 1914, has been subjected to a constant process of improvement in detail not affecting the interchangeability of the parts, and that the type-E represents the result of this same process of evolution, affecting interchangeability with the parts of the type-D, and that the experience with these couplers throughout this period of development leaves no reason to expect that the type-E will not remain a standard for some time to come.

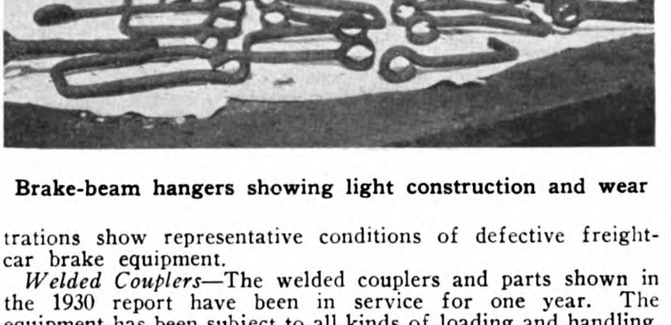
A question was raised as to the necessity for the cross key in the design of swivel-butt coupler with vertical-plane yoke with the use of a separate carrier iron, and it was asked if it would be a permissible alternate to leave out the cross key. Chairman Kleine promised that the committee would take this matter under consideration.

In connection with the preparation of the report on the draft-gear recoil tests, motion pictures were shown illustrating the recoil actions of cars equipped with draft gears of varying percentages of recoil when coupled at varying speeds.

The report was accepted and submitted to letter ballot as recommended by the committee.

Joint Committee On Reclamation

The committee has studied the design of many brake beams now in service, referring particularly to the failures of various parts, and to parts which are not interchangeable. The illustrations show representative conditions of defective freight-car brake equipment.



Brake-beam hangers showing light construction and wear

Welded Couplers—The welded couplers and parts shown in the 1930 report have been in service for one year. The equipment has been subject to all kinds of loading and handling, including that in hump classification yards. To date, no failures have developed. The couplers show normal wear and conditions. They compare favorably with new couplers in the same kind and length of service. One railroad, four years ago, applied 200 welded couplers and parts to system ballast cars that would not be handled in interchange. A record of welding was kept of each individual coupler. In addition to this, each coupler was marked with a steel stencil date. To date one coupler has been removed because of wear on the coupler shank by the carrier iron. The data prove conclusively that the welding of certain fractures in couplers is a successful and profitable operation.

Marking Old Material—Most reclaimed and second-hand material is painted or sprayed for protection and, when properly repaired, it is impossible to detect it from new material unless it is marked in some manner. By using the paint color

Coupler with welded face and shank after year's service

Mild-steel brake-beam rods showing breakage at end

scheme and dotting item of material, many discrepancies will be eliminated, and the cost will be much less.

Freight-Car Axles—As a result of recommendations included in the 1930 report, the Mechanical Division committee has recommended that the condemning limit for journal length of axles should be increased. This has been accepted and the new limit is shown in the Interchange Rules. The increased journal length is harmful to the life of the brake beam, and permits increased lateral motion to brake and truck foundations. The brake and truck foundations are most important for the reason that considerable freight car equipment is being dispatched on express train schedules and some of the present design and construction carries a high maintenance cost.

Helical Springs—Accumulative reports have been received from various railroads indicating satisfactory service from reclaimed helical springs. One railroad reports savings effected by reconditioning 5,160 helical springs at its plant, as follows:

66.7 tons spring steel at $10.75 per ton		$717.03
New value of springs		4,045.80
Cost of material to repair	$86.32	
Cost to repair	386.03	
Value of scrap spring steel	717.03	
		1,189.38
		$2,856.42
Cost per ton to recondition	$ 7.08	

The report is signed by J. C. Bon (chairman), superintendent of reclamation, Wabash; G. W. Lieber, superintendent of reclamation, M-K-T; A. L. Prentice, supervisor of scrap and reclamation, N. Y. C.; W. P. Stewart, superintendent of scrap, I. C.; J. W. Bukey, Foreman reclamation plant, Penna., and L. R. Wink, assistant superintendent, car department, C. & N. W.

Action.—The report was accepted.

New Officers

Owing to the resignation of A. R. Ayers, general manager of the New York, Chicago & St. Louis, as chairman of the Mechanical Division, it became necessary to elect a chairman to serve the remainder of Mr. Ayers' term. On the proposal of the Nominating Committee, O. S. Jackson, general superintendent motive power and machinery, Union Pacific System, was elected chairman, and Silas Zwight, general mechanical superintendent, Northern Pacific, vice-chairman, to replace Mr. Jackson, both to serve until June, 1932. The six members of the general committee whose terms expired were re-elected to serve until June, 1933. These were J. S. Lentz, consulting master car builder, Lehigh Valley; J. A. Power, superintendent motive power and machinery, Southern Pacific, Texas and Louisiana Lines; F. H. Hardin, assistant to president, New York Central; A. G. Trumbull, chief mechanical engineer, Chesapeake & Ohio; G. E. Smart, chief of car equipment, Canadian National, and G. A. Moriarty, general mechanical superintendent, New York, New Haven & Hartford. Mr. Ayers was elected to fill the vacancy created by the election of Mr. Zwight to the position of vice-chairman.

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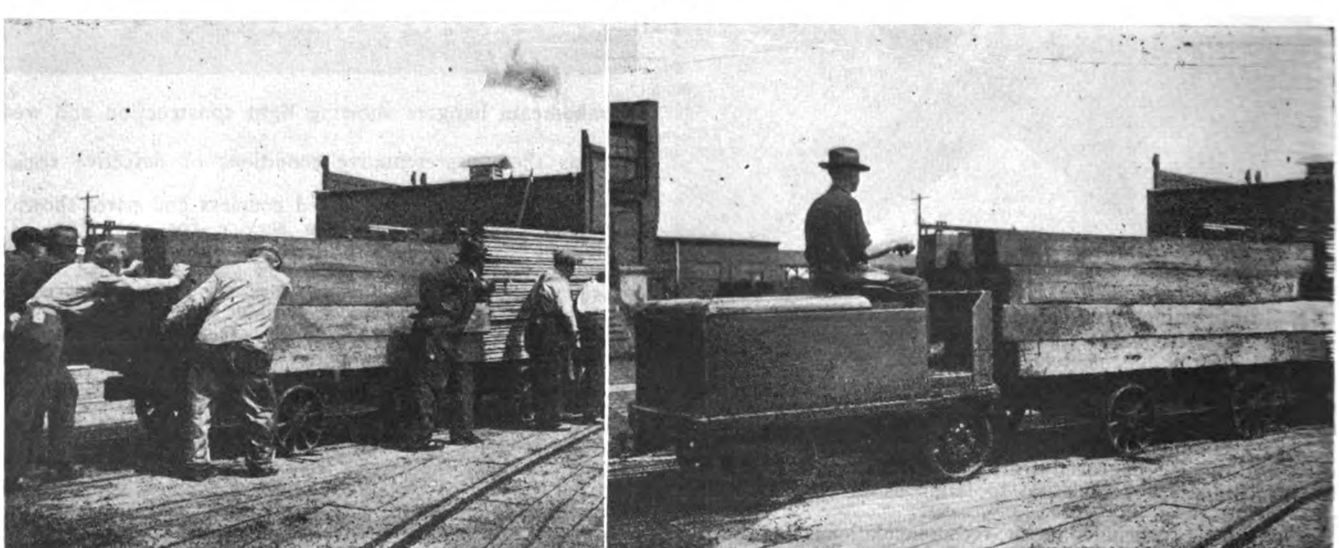


A single tractor can easily replace the gang and does the work in less time

German Rail Car With Novel Drive

A SERIES of tests has been made in Germany with a unique design of rail car, which has a streamlined body and is powered with a 500-hp. airplane engine installed at the rear of the car driving a four-blade propeller. This car, which is the result of 15 years development and research, has attained a speed of 124 m.p.h. over a straight piece of track, and an estimated speed of 185 m.p.h. is claimed by the designer, Herr Kruckenberg. Tests are being conducted with the co-operation of the German State Railways and the Gesellschaft fur Verkehrstechnik (Association for Traffic Technique). The latter organization is financing Herr Kruckenberg's experiments. It represents a number of industrial and banking interests and was organized with the object of developing rapid, safe and economic means of passenger transportation. The airplane engine, which is installed in the car, was furnished by the German Ministry of Communications.

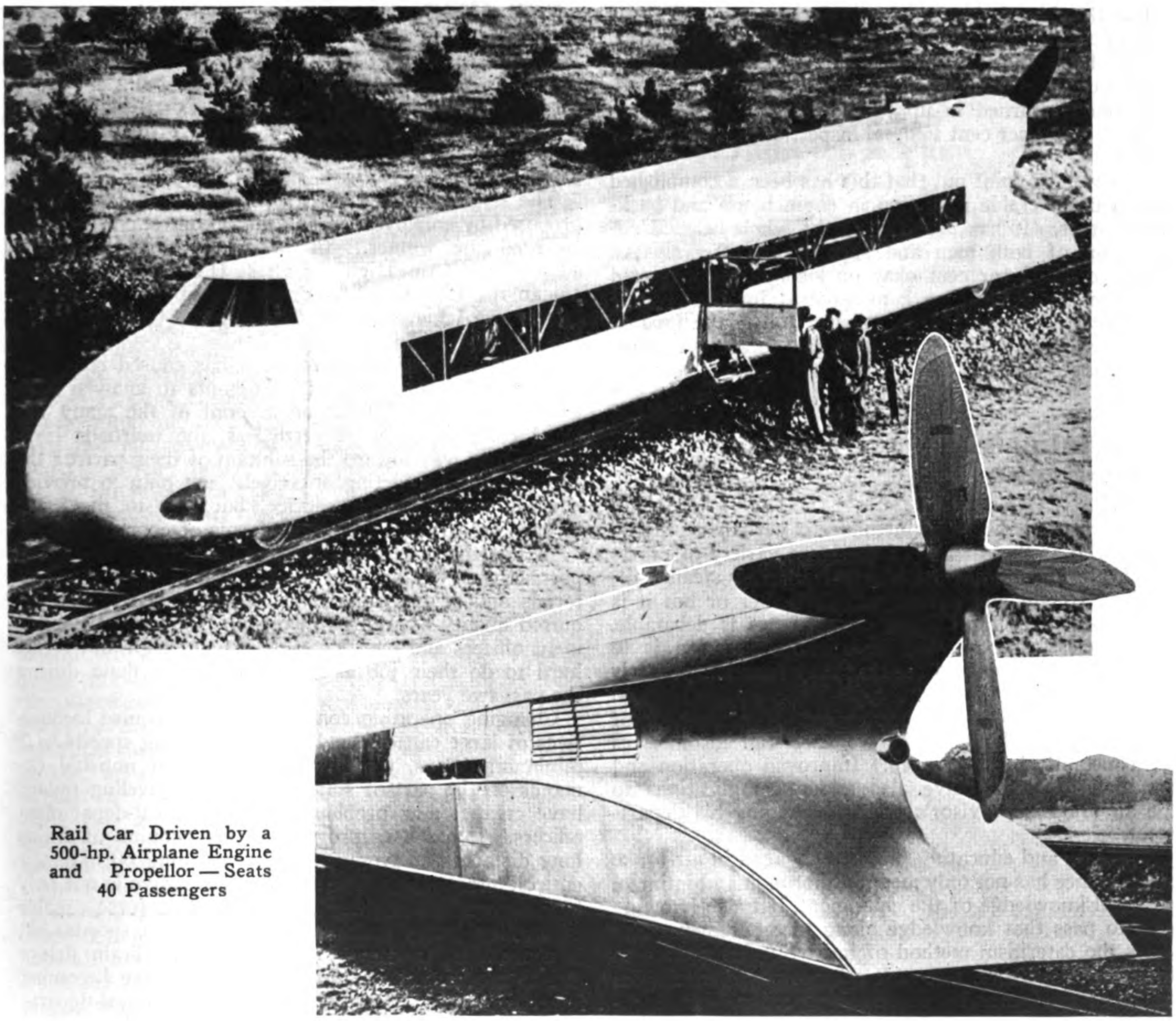
The car weighs 20.6 tons and is built with a streamlined body and is carried on two two-wheel trucks, spaced 65.62 ft center to center. The body is made of steel tubing covered with sheet aluminum and balloon fabric. The operator occupies an elevated compartment at the front end of the car body.

The first tests of the car were made with a capacity load of 40 passengers. The engine is started with the brakes applied. The brakes are released as soon as the speed of the engine has reached the desired number of revolutions per minute.

Engine and Drive

The fuel consumption of the engine is estimated at about 14 gal. of gasoline per 62.2 miles. In addition to the four-blade airplane propeller, the engine drives an air compressor for the brake system and two electric generators which charge the storage batteries. The electrical control equipment and batteries are installed in the front part of the car ahead of the operator's seat. The storage batteries supply current for a motor which furnishes auxiliary power for propelling the car when the airplane engine is idle. The car is equipped with two independent braking devices, viz., an air brake similar to that used on highway vehicles and an emergency hand-brake.

The car also has a baggage compartment and two passenger compartments, one of which is used for smoking. These three compartments occupy a space the length of the car of 52 ft. 6 in.



Rail Car Driven by a 500-hp. Airplane Engine and Propellor — Seats 40 Passengers

EDITORIALS

Ninety-Two Per Cent Locomotives Okay

Shortly after the 1930 convention of the Mechanical Division at Atlantic City, a motive-power officer had occasion to ask one of his enginehouse foremen some questions relative to the final inspection of locomotives outbound from the terminal. The answers given were far from satisfactory. As a result the instructions pertaining to locomotive inspection were reissued and every enginehouse foreman on the system was examined to see that the instructions were thoroughly understood. In addition, the address by A. G. Pack at the final session of the Mechanical Division Convention last year was routed to all enginehouse foremen who were required to initial the copy to show that they had read it.

In 1927, 33.9 per cent of the locomotives inspected by federal inspectors on this railroad were marked defective. This figure was increased in 1928 to 39.2 per cent. In 1929 it was 36.7 per cent. But in 1930 the federal inspectors found only 18.1 per cent defective.

For the first five months of this year only 13.1 per cent of the locomotives inspected were found defective.

June being the last month of the I. C. C. fiscal year, a special effort was made to secure a perfect record. The reports turned in up to the time of this writing indicate a 100-per cent Federal inspection for the 30-day period.

It is well to point out that this has been accomplished with a considerable reduction in enginehouse and back-shop forces. It has necessitated the whole-hearted co-operation of both men and supervisory officers. An objective of 92 per cent okay on locomotives inspected has been set up as a mark to shoot at for the ensuing fiscal year. The will to do a better job in the face of many discouragements is the only way to achieve better railroading.

Training The Air-Brake Man

The work of air-brake maintenance is perhaps as highly specialized as that of any of the large variety of crafts which are included in the transportation by steam railroad of freight and passengers. Whether or not it is more specialized than signal maintenance is debatable. Nevertheless, the railroad man whose vocation is to maintain air brakes and see that they function properly has a real job to perform. Air-brake equipment and appliances are constantly improving. New methods of maintenance and application to cars and locomotives are constantly being devised. Improved operation and handling of trains have also added complications to the air-brake supervisor's job of managing his department.

Training and educating the men engaged in air-brake maintenance has not only meant a thorough and intimate personal knowledge of the equipment, but also knowing how to pass that knowledge along to other men. For years the catechism method of imparting instruction to foremen, inspectors, test-rack operators and mechanics has been the generally approved procedure for teaching air brakes. Other methods have been evolved and tried out. But the old question-and-answer system has been found to be the most effective.

At the present time a number of air-brake supervisors and instructors are engaged in revising their instruction books with the object of bringing them up to date. Knowing this, we are publishing, beginning with this issue, a list of questions and answers that have been carefully selected from the air-brake instruction book of an eastern railroad. The work of revising this list was only recently completed. The questions and answers which appear in this issue and which will appear in later issues have been carefully selected with special attention to modern equipment and maintenance practices. Those questions and answers pertaining to federal requirements and those generally accepted as covering established practice have been omitted.

A Slogan For 1932

Each year for the past five years the mechanical department of an eastern railroad has adopted a slogan in the belief, quoting one of its officers, "that slogans promote high ideals and that they are worthwhile. The benefits obtained from our slogans have been innumerable."

The slogan adopted each year is selected from those proposed by employees in an annual contest. A prize is awarded the winner. In 1927, the slogan officially adopted was "Aim High and Strike Hard." The winning slogan for 1928 was "Accuracy and Speed"; for 1929, "Conserve-Achieve"; 1930, "Quality and Quantity," and for this year, "Think-Analyze-Act."

Surely, the business depression has caused considerable reflection and thought. Attempts to analyze have been exceedingly difficult on account of the many unusual complications. Nevertheless, the railroads have gone a long way toward the solution of their part of the problem and are acting effectively, not only to provide efficient transportation service, but also to meet the inroads on earnings from new forms of competition.

In this the mechanical department has played an important part. It has had to conserve in labor and materials and at the same time achieve a task which required quality as well as quantity. Mechanical department officers and men have had to aim high and strike hard to do their job as it has had to be done during the past two years.

Changing operating conditions which require locomotives of large capacity and higher operating speeds with minimum delays, together with new and unusual demands on the part of shippers and the traveling public, have created new problems for mechanical-department officers. It has been proved that the running of trains long distances at average speeds exceeding 60 m.p.h. is entirely practicable. The modern locomotive is not only a transportation machine of high tractive force capable of hauling heavy trains at high sustained speeds, but is economical to operate and maintain. Train delays due to mechanical or lubrication failures are becoming fewer each day. Four years ago a mechanical-depart-

ment officer who had a record of 20,000 freight-car-miles per hot box and one million passenger-car-miles per hot box could feel that his road was getting good results. Today, he is unhappy unless he shows over 50,000 freight-car-miles and over two million passenger-car-miles per hot box.

Engine terminals are organized for the rapid turn-around of locomotives. Back shops are handling class repairs in shorter time and doing a better job. Car inspection and rip-track repairs are being more efficiently handled because of more thorough supervision.

Further reiteration of the accomplishments of the mechanical department is unnecessary for the reader of the *Railway Mechanical Engineer.* Each issue contains plenty of evidence to convince the most skeptical. Considering what has been done and the need to continue our efforts to meet present problems and those which are sure to come up in the near future, we offer a slogan which we believe best describes the ideals for which all mechanical-department men are striving—"EVER BETTER RAILROADING."

A Labor-Saver At Enginehouses

The crane-type truck has demonstrated beyond need of further proof its value as a labor-saver in railway shops and stores departments. It is particularly useful also at engine terminals where the building construction renders crane facilities difficult to install and use effectively, owing to space limitations, obstructing columns, smoke jacks, etc. For handling heavy locomotive parts, either in removal or re-application, the power-operated crane truck is well adapted and proves an important factor in the prompt conditioning of power and reduction of out-of-service time at engine terminals. In fact, it is said that any terminal turning an average of 25 locomotives a day will show good percentage earnings on the investment in a crane truck. The satisfactory performance of the truck depends to a considerable extent on floor conditions, which, however, if unsuited for crane-truck operation, are equally obstructive to hand trucking. In many cases the potential savings from the installation of a crane truck are sufficient to justify not only the investment in the truck but go far toward carrying the investment in new floors and rearrangement of the construction to provide proper clearances.

Among the typical operations in engine-terminal work which can be expedited by the use of crane trucks are the removal and reapplication of air compressors, feedwater heaters, front-end doors, superheater units, locomotive springs, driving-wheel tires, air reverse gears, smoke stacks, main reservoirs, mechanical stokers, piston rods, dome covers, dry pipes, and many other heavy parts. Recently-conducted studies show that one machinist and one helper can remove an air compressor in 1½ hours, using former methods, which depend largely on "main strength and awkwardness", this time being cut to 30 minutes when a crane truck is available. An air reverse gear can be removed by one machinist and one helper in two hours by former methods, as compared with 30 minutes when assisted by a crane truck; a smoke stack can be removed by one machinist and one helper in one hour, as compared with one-half hour with the use of a crane truck.

On the rather infrequent occasions when it is necessary to remove the cab from a locomotive in the enginehouse, this operation can be performed by one machinist and three helpers in eight hours using the old method, as compared with two hours when assisted by a crane truck. The removal of a stoker screw is an awkward operation which formerly required one machinist and one helper two hours. With the assistance of a crane truck and one operator, this work can now be done in 15 minutes. One machinist and one helper formerly took two hours to remove a locomotive piston, this time being cut to 15 minutes with the use of a crane truck. The time required for removing main and side rods depends more or less on the number of pairs of coupled driving wheels, experience showing that if it formerly took one machinist and one helper eight hours to strip the rods on one side of a locomotive, this work can now be done in three hours using a crane truck.

In addition to the operations mentioned, there are many others on which the crane truck can be used to advantage, such as handling various heavy parts from the enginehouse to the back shop, loading and unloading car wheels, etc. The effectiveness of the crane truck is, therefore, not limited to lifting operations, the truck being equally well adapted for carrying heavy materials and operating as a tractor with trailers. The marked flexibility of the crane truck and its ready adaptability to so many different operations tends to reduce idle time to a minimum and cause the truck to more than pay for itself in a short period.

A Profit From the Coach Yard

Many car department supervisors have felt, with some justification in most cases, that when the appropriations for improvements were handed out the car department always came out on the small end of the deal. The result of all this has been that under present conditions it has been difficult to make any kind of a showing toward efficient operation.

Recently, at a staff meeting of passenger-car supervisors on a certain railroad, the question of possible economies in operation was being discussed. All manner of means for cutting expenses were considered, but each time the conclusion was reached that it was not possible further to reduce expenses without affecting seriously the ability of the department to meet the demands of service. A general foreman who had supervision over one of the large coach yards at an important terminal made the rather final statement that he had reached a point where, with the equipment he had, it was with the greatest difficulty that he kept up the service and that the only solution to his problem was the installation of better equipment for handling cars. This general foreman had prepared some preliminary figures to show what could be done with modern equipment at his terminal and he presented data to show that the installation of approximately $30,000 worth of new coach-yard facilities at that one terminal, which handles more than 200 passenger cars and Pullmans each day, would save the company $8,700 a year in maintenance costs. His tentative estimates indicated that the interest on this new equipment, depreciation at 10 per cent (which is far higher than any road charges) and the maintenance costs on the new equipment would run about $5,700 a year leaving a clear profit of about $3,000 a year at this one point.

In almost any business it is not very difficult to find

a reason for buying new equipment which will pay for itself, but when that equipment will actually pay a profit conservatively estimated at 10 per cent on the investment, after fixed charges, the difficulty will be to find an excuse for not buying it.

Safety in Shop Operation

Persistence is an essential gem in the crown of safety. So far as the editor knows, this "gem" of thought has never been expressed in exactly that way before. Whether or not the expression is novel, it is undeniably accurate. At the May meeting of the American Railway Association, Safety Section, in Chicago, C. S. Millard, vice-president and general manager of the Big Four, compared safety work to advertising, since, like most efforts to influence the minds of men, neither has enough momentum to carry on, once the effort is stopped. Advertising experts maintain that the best-known articles of commerce on the market today, sold under the impetus of tremendous advertising campaigns, would shortly disappear from the market if the advertising were discontinued. By the same token, accident-prevention work must be continued with unremitting zeal in spite of opinions sometimes mistakenly advanced that it is "old stuff" and, to a certain extent, non-essential.

The attention given to safety work on the railroads in the past seven years has shown excellent results, including a reduction of 50 per cent in fatal injuries and 35 per cent in non-fatal injuries to passengers per million passenger-miles in 1930, as compared with 1923. As a result of the more intensive training and supervision, the accidents to employees were also greatly reduced, the number killed in 1930 being 52 per cent less than in 1923, and the number injured, 78 per cent less. On the basis of the number of casualties to employees per million man-hours of work, the reduction in 1930 under 1923 is 70 per cent, or twice the goal of 35 per cent which was set. That the intensive efforts of railway shop supervisors have been an important factor in this achievement cannot be successfully denied.

Since persistence is a primary requisite in all safety efforts and since campaigns with definite goals and objectives are a recognized form of safety activities, the following comment by C. G. Sebrell, shop safety supervisor of the Santa Fe, in a recent paper before the Mechanical Division meeting at Chicago, is of interest: "While I have seen good results in accident-prevention work in individual shops, enginehouses and repair tracks, through the aid of campaigns and contests of various kinds, I believe they leave a lasting impression for good only with the exceptional individual; and my observations have taught me that only through education and constant reminders day after day do we accomplish our common objectives."

There is unquestionably much truth in Mr. Sebrell's observations, although the best results are probably obtained when consistent work throughout the year is supplemented by occasional special efforts which serve to give added impetus and renewed interest to this important phase of railroad shop operation.

An additional pertinent suggestion was advanced by Mr. Sebrell which may be summarized in the following: "Shop work is just as safe and efficient as the supervisor demands it shall be, or as dangerous as an inefficient supervisor permits it to be." Regarding discipline, Mr. Sebrell has the following interesting comment to make: "I have no patience with the supervisor who permits rule violations to pass unnoticed and then assesses discipline after the inevitable injury occurs; to me, this seems to discipline a man for the result of his act rather than for the act itself. I do not advocate daily doses of demerit against individual records, but I have known of numberless instances where demerits have made good Indians out of delinquents, which is highly preferable to removing them from service and less costly to all concerned." To illustrate this point, Mr. Sebrell mentioned two cases in which workmen were assessed five demerits each for failure to wear goggles where rules prescribed their use, and, in both cases, within a week each man had one lens broken in his goggle, leaving little doubt that each would have lost an eye were it not for the fact that they were wearing goggles at the time.

The wearing of goggles, the strict observance of the blue-flag rule in connection with car-repair work and insistence on the wearing of shoes with substantial soles are three of the simplest methods of making a substantial reduction in the number of accidents at railway shops, engine terminals, rip tracks, etc., and there should be no let-up in attention to these important details.

NEW BOOKS

THE AIR BRAKE INSPECTOR'S HANDBOOK. *By Carl O. Glenn. Second edition, revised and enlarged, 328 pages, illustrated, 5 in. by 7½ in. Bound in leather. Published by the Simmons-Boardman Publishing Company, 30 Church Street, New York. Price $3.50.*

This, the second edition of the Air Brake Inspector's Handbook, contains material relative to the latest technical improvements in air brakes and describes the most recent developments in air-brake equipment. This edition also includes formulas and tables for air-brake men and supervisors. The author, Carl O. Glenn, was formerly air brake supervisor of the Chicago, Rock Island & Pacific. In the preparation of the new edition he was assisted by John P. Stewart, general supervisor of air brakes of the Missouri Pacific, and a member of the Executive Committee of the Air Brake Association; and by M. S. Belk, general air brake instructor of the Southern, and past-president of the Air Brake Association.

The new edition includes a total of 40 subjects such as Universal Control Valve, P. S. Equipment, M-3 Feed Valves, No. 14 E L Equipment, Air-Hose Coupling Gages, Locomotive Safety Laws and suggestions pertaining to train control.

The first edition which showed methods of testing various equipment for the location of disorders on inbound and outbound locomotives, and in tests; freight car inspection on rip track and in classification yards, and passenger-car inspection in coach yards and terminals, met with a gratifying response. The author, in preparing the second edition has closely followed the objectives which he had in mind in the preparation of the first edition; namely, to furnish experienced air-brake mechanics a book with complete information on the testing of all kinds of air-brake equipment and the location of defects. He has accomplished this in the second edition, and in addition giving valuable information pertaining to the latest developments in air-brake equipment.

THE READER'S PAGE

Why the Chill-Worn Wheel?

To the Editor:

We read with interest and some dismay, on page 195 of the April, 1931 issue, the letter from General Car Foreman about chill-worn cast-iron wheels, the chief burden of which seemed to be that most of the inspectors do not know a chill-worn wheel when they see one. We change more wheels for this defect than for any other defect on wheels. This being a judgment defect, also one of the most dangerous defects, it is of the greatest importance that it be discovered and removed at the earliest possible moment.

There is no gage to condemn this defect, but there is a gage to condemn a tread-worn-hollow wheel, a defect seldom found. When a wheel is worn in one spot to the extent that it will take the tread-worn-hollow gage, it will be found to be worn through the chill and is much more dangerous than a wheel that is worn to the extent that it will take the tread-worn-hollow gage for three-fourths of its circumference.

Hence we ask, why the chill-worn wheel? Would it not be more consistent to eliminate the chill-worn wheel defect and condemn the wheel for tread worn hollow, avoid guesswork and increase the margin of safety?

W. E. Hogbin.

The Economics of A Broom

To the Editor:

"An Economist" writing in the April issue of the *Railway Mechanical Engineer*, page 194, asks "Has any railroad or factory made a detailed study of what constitutes the best broom for factory or shop use?"

Whether the railroads themselves have ever made such a study, there does not seem to be any data available. However, a few years ago one of the old floor sweepers in the shop with which the writer is connected, a modern locomotive repair shop by the way, sent me the following interesting study he had made himself as an entry for a prize that had been offered by the superintendent of the motive power and car departments for the best suggestion submitted by an employee for that year.

The suggestion made in the following letter is exactly as it was received, except that it has been typed, while the original was written on six shim order blanks. Mr. MacDonald was awarded second prize for his suggestion.

M. H. Westbrook,
Shop Superintendent, Grand Trunk Western.

Mr. Far:

I can't expect to win your good prize because I am only a laboring man and not a mechanical one, but just the same I want to see the railroad make all it can.

There is too much talk about railroads being managed wrong, and I no this one aint when you offer a $10 prize like you have. My idea is only a broom and I can sweep as good as any man I no. But with a corn broom it works out like this.

I sweep from the vat to the big door in the machine shop behind pit No. 1 in three hours, equaling $1.17. To sweep the same distance with the new kind of heavy broom—5 hours equals $1.95, which it takes. Then you lose 78 cents a day. For the rest of the time I help the machinists.

A corn broom lasts about sixteen days. This, multiplied by 78 cents, is $12.48 you lose on a hard broom and the hard broom does not last as long.

I told my boss about these brooms and he says, do the best you can with them, I do not think they will by any more. Well, that is the best I can what I told you about and also your arms about drop off when you sweep five hours with a hard broom and the corn ones do not tire you at all, but I guess they by them hard brooms cheap and they think they make money, but you see how it is, Mr. Far, don't you?

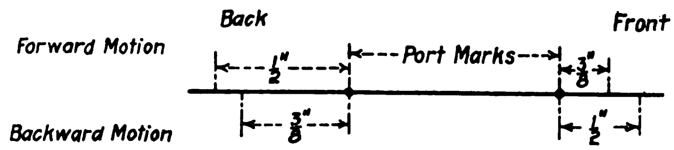
Norman MacDonald.

Setting Southern Valve Gear—An Answer

To the Editor:

I read in the May, 1931, issue of the *Railway Mechanical Engineer*, an inquiry by Thomas J. Martin, requesting information on how to figure changes in the Southern valve gear. While my experience on this gear has been limited, I believe I can answer Mr. Martin's question satisfactorily.

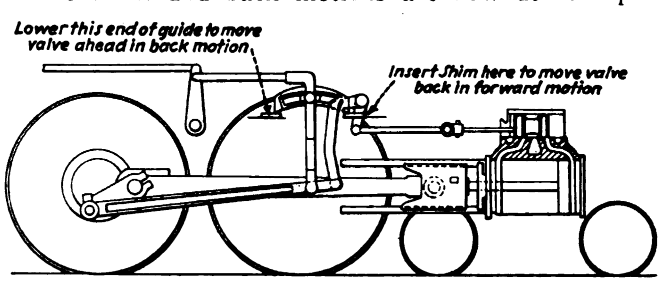
Referring to the specific example of "lame" valve motion which he gives and was reproduced in his letter;



Port openings with the valve rod shortened 1/8 in.

first calculate the average valve-rod error by the same method used to figure the valve-rod error in squaring Baker or Walschaert gears. The differences between the front and back port openings are taken and added together in this case, and the result divided by four to give the average valve-rod error. The valve-road error is 1/8 in. and the valve rod should be shortened. If the valve rod were shortened 1/8 in. the port openings would have the dimensions shown in the sketch.

The front and back motions are now at an equal



Location of snims

amount in opposite directions and the valve rod is the correct length. Any further change would correct one motion at the expense of the other. To correct the error shown it is necessary to place a shim of suitable thickness under the front of the guide, sometimes called the link, and also lower the back end of the link the same amount by removing a shim or reducing it. In this case the shim used should be thick enough to move

the valve $\frac{1}{16}$ in. with the reverse lever set in the same position as when the port openings were marked. Probably about ¼ in. would be required in this case. Raising and lowering opposite ends of the guide or link of a Southern gear has much the same effect as changing the eccentric rod of a Walschaert gear.

It will be noted that an upward movement of the guide will raise the front end of the eccentric rod when the engine is in the forward motion, and acting through the rocker will move the valve back.

H. W. STOWELL.

are submitted to arbitration, not because the rules are not clear, but because of the chance that a reversal of a previous opinion might save the road some money.

With reference to the short haul of several different roads which I cited: The inspector cannot help the various interchanges of the car in question but he can assist in expediting the car and aid the traffic department by making sure he does not dig up some technicality whereby he will be responsible for delays to cars in transit.

H. H. RICE.

Still Believes Trick Questions Are Useless

TO THE EDITOR:

T. J. Lewis disagrees with me, on page 247 of the May, 1931, *Railway Mechanical Engineer* in so far as some of my remarks in connection with car inspectors, outlined in paper presented before the Indianapolis Car Inspection Association, are concerned.

Many of the up-to-date high schools of the country are dropping Latin as a mandatory course. The pupils may take Latin if they desire. It has developed that Latin has been of very little benefit to the students in later years and so nothing is accomplished by its study. The same applies to many of the "discussions" on car-department matters which could just as well be discontinued by the car foreman as could the study of Latin in high schools. I cannot agree that I do not have an understanding of the car inspectors' problems either from a lack of study or of practical experience. I have had quite a number of years in the car department and my remarks were a result of some of the things that I have seen over this period of time.

Intelligent discussions of the A. R. A. Rules are always of benefit, both to the foremen and inspectors as well as to members of A. R. A. billing departments. So far as that is concerned intelligent discussion of any subject is always beneficial to the parties involved.

Let us take the average staff of car inspectors around ordinary terminals. There will be possibly 20 car inspectors on the various shifts. Usually the car foremen hold monthly meetings and the inspectors are invited to present a question for discussion at each meeting. There are 131 rules in the freight code, many of which are blank. There are probably 100 active rules. The invitation to present a question is usually taken as an order by each inspector and as a result 20 questions are presented. If my arithmetic is correct, this is 240 questions a year, and as the majority of questions cover only a few of the rules it can readily be seen that the field for legitimate questions is rapidly covered. And the result is trick questions.

I do not blame the car inspectors for this; it is forced on them and it results in the car inspectors watching for trick problems in their interchange work. "No interpretation of an A. R. A. rule which will delay the movement of a loaded car which is mechanically safe to run is justified." And too many times this happens.

We are continually being told by proponents of the trick question meetings that "many cases are submitted to the Arbitration Committee for decision after the higher railway officers are unable to agree." This is true. But many cases are decided by the Arbitration Committee on direct precedent and the losing road knew that it would lose but took a chance that the Arbitration Committee might reverse itself. Most cases

Adopt Hand Mirrors to Detect Broken Arch Bars

TO THE EDITOR:

I read with a great deal of interest in the March issue some remarks regarding the use of a special mirror for car inspectors to aid them in discovering cracked or broken arch bars. This instrument is very valuable in assisting a car inspector to locate broken or cracked arch bars, and I wonder why some railroads have not yet adopted it. The importance of detecting broken or cracked arch bars cannot be over-emphasized. I have known of several instances in which serious damage and loss has resulted on account of a broken arch bar.

From August 1, 1929, to March 31, 1931 (20 months), 1,603 broken or cracked arch bars were discovered by the third shift inspectors at a terminal on a southeastern railroad by use of carbide lights and mirrors. It, therefore, seems to me that all railroads should use the mirror in handling such an important task, thereby reducing to a minimum the loss and damage that frequently occurs.

A. L. DILLON.

Follow Instructions According to Rule 66

TO THE EDITOR:

Of late one reads quite a lot about hot boxes and how to eliminate them. Every car man knows that our superior officers will be right after us on the wire wanting to know why, when a car is set out on their lines. One car inspector will say "waste grab," another "a broken brass," etc. But when the car is set out and the inspector gets to it, of course it has a broken brass and not enough sponging. Whether or not the inspector's report shows the real cause of the hot box is just a guess.

Of course, he has to say something, and naturally he is going to say the first thing that enters his mind—what we might consider as passing the buck. However, when a car is set out for a hot box all we can do is to fix it and get it moving. To eliminate these hot boxes we should be more careful with our cars and be more particular in complying with Rule 66.

If each car were repacked, each box raised and the wedges and bearings examined, new ones being applied when needed, and packed according to the rule as illustrated at the top of page 92 of the rule book, there would be less talk about hot boxes. The majority of hot boxes occur on cars that are not repacked when they should be.

When a man gets an automobile he oils and greases it approximately every five hundred miles. One seldom sees an automobile set out with "hot boxes."

F. T. JONES.

With the
Car Foremen and Inspectors

Three Milwaukee Car-Shop Devices

THREE labor-saving devices now being used in the Chicago, Milwaukee, St. Paul & Pacific car shops at Milwaukee, Wis., with unusually good results, include an air-hose bundler, an angle-cock grinding machine and an air-brake repairman's truck, illustrated.

Referring to the first of these devices, it may be said that it facilitates handling one of the many awkward materials which must be taken care of by car men, as well as stores department forces; namely, scrap air-brake hose. It is not a difficult job to handle a few scrap hose, but in any large shop or repair point where vast numbers of air-brake hose must be stripped, the scrap hose assembled, moved to the stores department, counted and shipped to the scrap dealer, the total amount of labor involved in re-handling individual hose reaches a very large total.

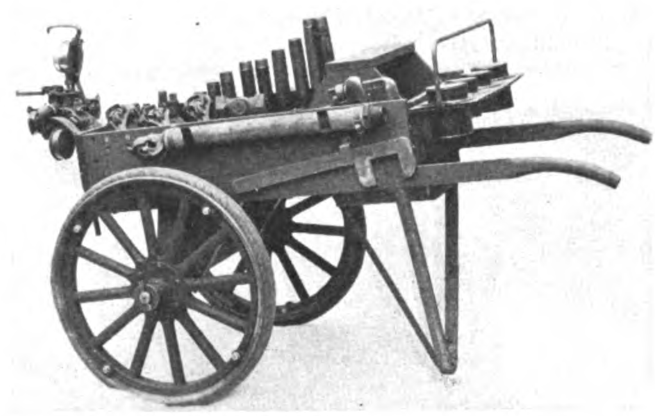
The machine, illustrated, consists simply of a 10-in. air-brake cylinder and frame arrangement, whereby the hose are assembled in a rack secured to the air-brake cylinder piston and, when 35 of these hose are collected, operation of the air brake piston and rod forces the hose up against a stop (not shown) in the top of the machine. While the hose are in this compressed condition, a single wire is securely fastened about the center of the hose. Release of the air pressure in the brake cylinder permits the resulting compact bundle of hose to drop and be readily placed on a wheelbarrow or truck for handling to the stores department.

This hose-bundling machine is mounted on truck wheels of small diameter so that it can be readily moved to whatever position, adjacent to the hose-stripping machine, is most convenient. No more work is required to place the stripped hose in the rack of the machine than to throw them in a wheelbarrow or truck. Subsequent handling to the stores department and loading on cars for delivery to the scrap dealer are greatly facilitated, as well as the counting of the hose, since they are all tied in compact bundles of 35 each.

Angle-Cock Grinder

The four-spindle angle-cock grinding machine is constructed as shown in the illustration and promises to be an effective labor-saving device in connection with the grinding of angle cocks and cut-out cocks of all kinds, conditioning them for further service.

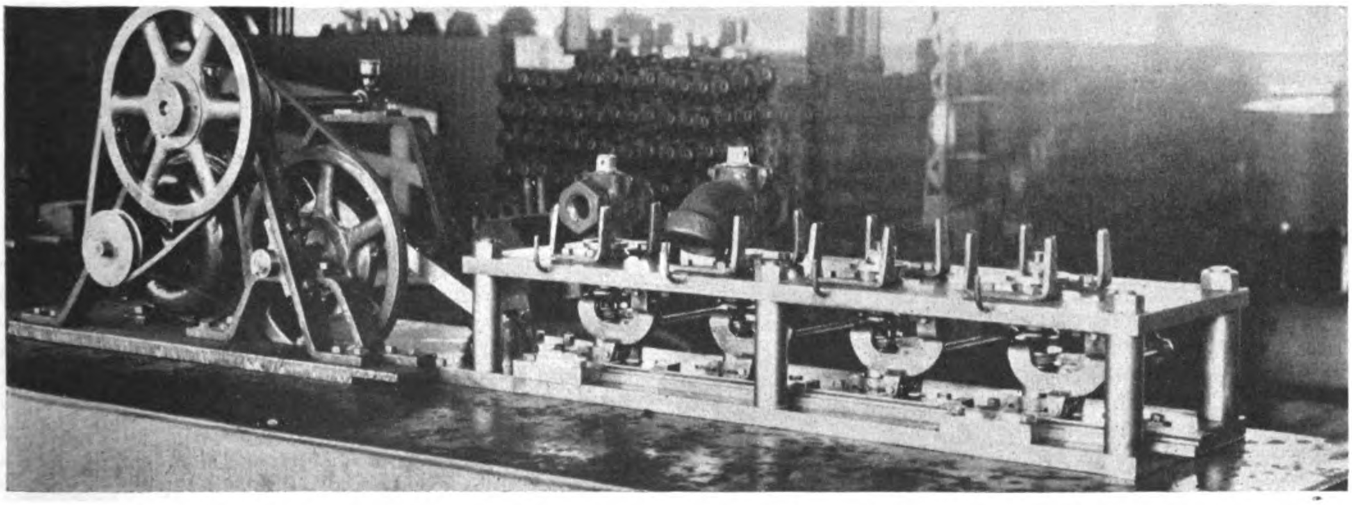
The machine is mounted on a bench, the top of which consists of a ½-in. steel plate comprising the base of the



Side view of fully-equipped air-brake repairman's truck which operates on rubber-tired roller-bearing wheels

machine. Driving power is furnished by a small electric motor and V-belt reduction drive to an eccentric and a reciprocating bar, equipped with a rack which revolves the individual spindles through small pinions. The design of machine includes a cam-operated "kick-off" feature which operates after each double revolution to promote a more uniform distribution of lubricant and abrasive on the surfaces to be ground.

In accordance with the usual practice, the angle cock



Four-spindle angle-cock grinding machine recently built at the Milwaukee shops of the C. M. St. P. & P.

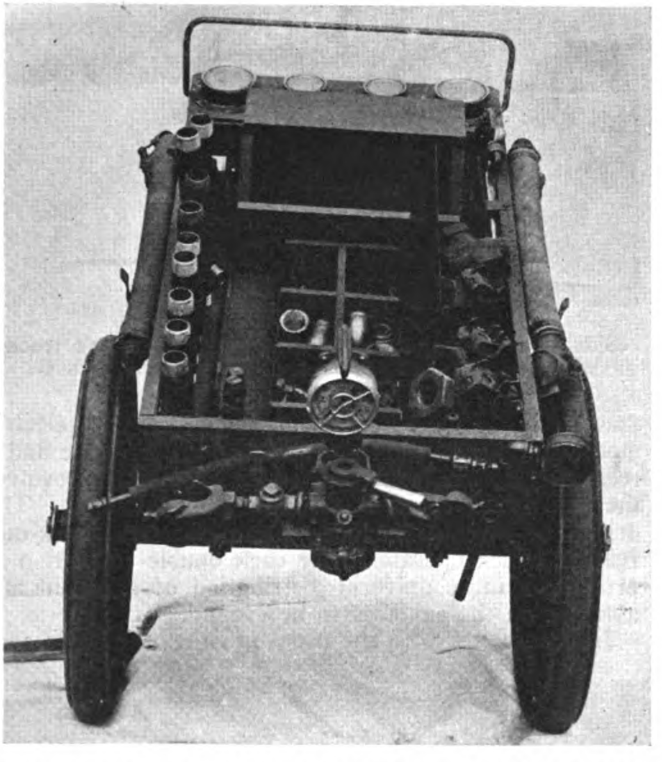
plug or key is screwed on the upper end of the spindle, the body being prevented from revolving by suitable stops which are designed to accommodate different sizes of angle and cut-out cocks. Suitable gaskets are provided to keep the excess lubricant and abrasive from following the spindle down and cutting out the bearings of the machine.

Two men are required to keep this machine busy and, when in full operation, an output of 90 angle cocks in eight hours is secured.

Air-Brake Repairman's Truck

A convenient and completely-equipped air-brake repairman's truck which has been standardized for use at car-repair points on the Milwaukee is clearly shown in the illustrations. This truck, equipped with rubber-tired, roller-bearing wheels, is used at repair tracks on the system, the idea being to provide an easy means of conveying all tools, testing equipment and small materials directly to the car and thus avoid the necessity of car-repair men making frequent trips between the shop and the car with small materials.

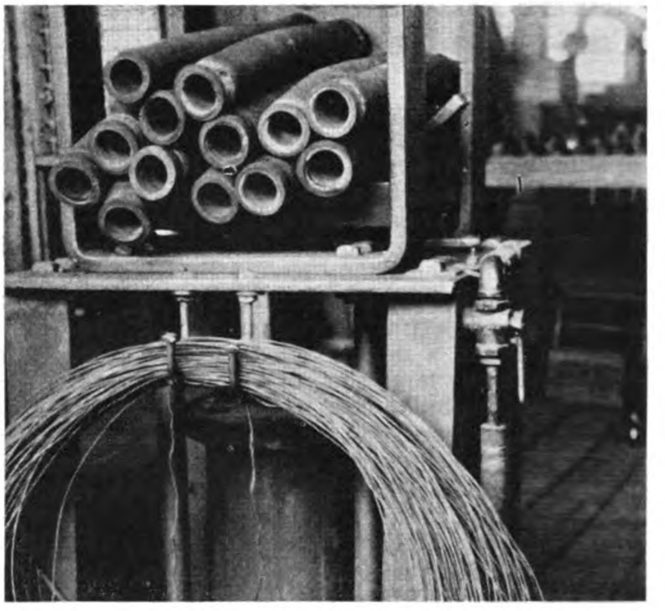
Except for triple valves and brake cylinders, which are relatively heavy and delivered to cars separately,



View showing the convenient arrangement of all necessary small supplies—Single car-testing device permanently mounted on the truck end

this truck carries all necessary supplies, including pipe nipples of several sizes required, a number of angle cocks and cut-out cocks, retaining valves, release valves, air hose, etc. In the body of the truck is a box divided into compartments in which are carried pipe-fittings, cotter keys, gaskets, etc. Just forward of this box is the seat box, used by the man when cleaning an air-brake cylinder under a car. This box has two compartments which are used for waste and tools necessary to cylinder cleaning and changing triple valves. On the side of the box, loops are provided for brushes used in the application of kerosene, black paint, white lead and lubricants, which are carried in four individual cans ingeniously held in a special carrier equipped with a handle. This carrier is so designed that it will stand alone on the ground. The truck also carries a die starter and wrench, as well as solid dies for cutting train-line pipe threads. Pipe wrenches, also a ram rod for cleaning the pipe in the auxiliary reservoir, are provided.

The single-car testing device is made a permanent part of the truck so as to avoid injury to it by possible dragging on the ground. A combined leakage-testing



Partial view of air-hose bundling machine which presses 35 scrap hose upward against a stop (not shown) for wiring in a compact bundle

device is carried immediately behind the single-car testing device. Two sheet-iron waterproof receptacles under the front of the truck contain space for gaskets and packing leathers, as well as billing repair forms No. 617.

This truck and its equipment permit the air-brake man to perform any repairs to air-brake equipment on any freight car, except renewing brake cylinders and reservoirs, without going back to the shop. An inventory of the material in the truck before and after making repairs to the air-brake equipment of a car affords a record of material used.

Questions and Answers For Air Brake Foremen

THE development of improved features in air-brake equipment, together with the fact that many changes in maintenance and operating practices have been made in recent years has required the heads of air-brake departments of a number of railroads to take up the task of revising their examination questions and answers for air-brake foremen, machinists and inspectors. The following questions and answers have been selected from the instruction pamphlet of an eastern road. This pamphlet is still in the process of preparation and only certain sections have been issued in mimeographed form. Following is the first group of questions and answers which have been selected as being of special interest. Others will appear in subsequent issues of the *Railway Mechanical Engineer*.

Q.—At what speed should (a) a 150-ft. compressor, (b) a

120-ft. compressor, (c) a 9½-in. compressor maintain 60 lb. main-reservoir pressure against standard orifice? A.—(a and b) 95 strokes per minute. (c) 115 single strokes per minute.

Q.—What should be done if these speeds have to be exceeded to maintain 60 lb? A.—Arrangements made for removal before the compressor fails in service.

Q.—What size orifice is used to test 9½-in. compressors, 8½-in. cross-compound 120-ft. compressors and cross compound 150-ft. compressors? A.—9½-in. compressors, 11/64-in. orifice; compound 120-ft. compressors 15/64-in. orifice; compound 150-ft. compressors, 9/32-in. orifice.

Q.—In case a compressor cannot maintain 60 lb. main-reservoir pressure at the required speed what must be done with the compressor? A.—It must be condemned and sent to the shop for repairs, except when it is known that rings are defective, in which case the rings may be renewed.

Q.—Before making an orifice test what should be done? A.—It should be noted that : (1) proper main-reservoir pressure is secured; (2) that the compressor strokes are uniform; (3) compressor is not pounding; (4) air strainer is clean and in good condition; (5) piston-rod packing is free from leakage; (6) the steam end, including the steam cylinder, valve chamber, etc. is not blowing; (7) the compressor and its (8) pipe connections are free from leakage; (9) drain cocks are operative, and (10) that the necessary lubricating attachments are provided and are in good condition.

Q.—Explain in detail how an orifice test should be made? A.—(1) Place automatic brake valve in lap position. (2) Close distributing-valve supply-pipe cut-out cock; (3) Apply test fitting with proper orifice disc for the compressor to be tested in the main-reservoir drain cock. (4) Charge main reservoir to 60 lb. (5) Regulate the speed of the compressor with the steam throttle until pressure remains constant at 60 lb. with main reservoir cut-out cock in open position, then count the single strokes of the compressor per minute.

Q.—How often should the air passages of air compressors be laundered? A.—As often as conditions require.

Q.—When should this work be performed? A.—At the time the compressor receives orifice tests or whenever compressors are reported as going lame.

Q.—At what speed should a pump be run and at what temperature should the laundering solution be kept? A.—The compressor should be run at low speed with the laundering solution kept boiling hot.

Q.—How long should the solution be run through the pump? A.—Not less than one-half hour, or as much longer as the condition of pump requires.

Q.—After laundering a compressor what is of utmost importance? A.—The working of clear hot water through the air cylinders until the water is discharged from the cylinders uncolored.

Q.—How and when should air compressor strainers be cleaned? A.—They should be dismantled, hair removed, when used, thoroughly cleaned and replaced when the compressors are laundered.

Q.—Should an orifice test be made before or after laundering? A.—It may be either before or after.

Q.—What is the proper piston travel for driver brakes on engines equipped with A-1 equipment or combined straight air and automatic equipment? A.—It should be such as to develop about 50 lb. brake-cylinder pressure from a brake-pipe reduction of 20 lb. with an initial brake-pipe pressure of 70 lb.

Q.—What should be noted with respect to leakage at the exhaust ports of brake valves, triple valves, distributing or control valves, brake-pipe vent valves and electric compressor governor? A.—That there is no leakage at the exhaust ports.

Q.—What may cause excessively high main-reservoir pressure to be registered on the gage? A.—Defective or improperly adjusted compressor governor or the air gage may be defective.

Q.—What may cause excessively low main-reservoir pressure to be registered on the gage? A.—Low compressor speed, defective or improperly adjusted compressor governor or a defective air gage.

Q.—What may cause low equalizing-reservoir or brake-pipe pressures to be registered on the gage. A.—Defective air gage or gages, low main reservoir pressure, a defective or improperly adjusted feed valve, or a leak of main reservoir air into the brake pipe.

Q.—At what points might main-reservoir air leak into the brake pipe? A.—(1) Automatic rotary valve. (2) Middle gaskets of six-position brake valves. (3) Lower gaskets of five-position brake valve. (4) Defective feed valve or distributing valve gaskets.

Q.—Explain how to test for a leaking automatic-brake-valve rotary? A.—Deplete brake-pipe pressure to zero, close double-heading cut-out cock and place brake valve in lap position. A leaking rotary may cause discharge of air at service exhaust.

Q.—What may cause a leak or blow at the emergency exhaust port of automatic brake valves No. 5 and 6 ET, or 12 and 14 EL equipment, brake valve in running position? A.—Defective automatic rotary valve or seat, middle or lower gaskets; independent brake-valve rotary valve or seat or lower gasket. Distributing-valve equalizing slide valve or seat, distributing-valve gasket or top gasket of brake valves in EL equipment.

Q.—What may cause a blow or leak from the automatic-brake-valve emergency exhaust port No. 6 ET equipment (U pipe removed)? A.—A defective automatic brake valve rotary or seat.

Q.—What may cause a leak or blow at the independent brake valve (U pipe connection with pipe removed)? A.—Defective independent brake-valve rotary valve, or seat or lower gasket; defective automatic rotary valve or seat; middle or lower gasket; distributing-valve equalizing slide valve, or seat or distributing valve gasket.

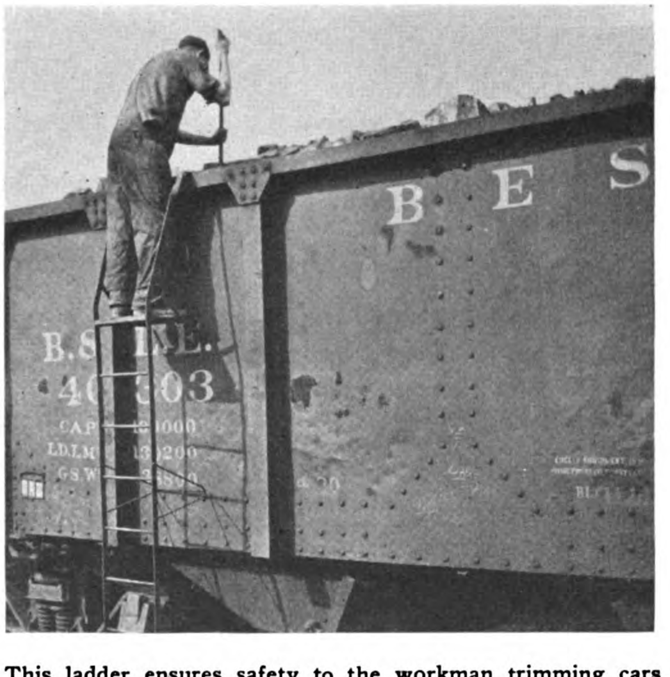
Q.—Explain how source of leakage referred to in previous question is determined? A.—Lap automatic brake valve and note pressure registered on brake-cylinder gage. If pressure does not exceed 45 lb. it indicates a defective independent brake valve. If pressure exceeds 45 lb., disconnect application cylinder and distributing-valve release pipes and note whether air comes from the distributing valve or pipe. If the U pipe is removed, lap the independent brake valve instead of the automatic.

Q.—What may cause leakage at the emergency exhaust of a G-6 brake valve in running position? A.—A defective rotary valve or seat.

Safety Ladder For Open-Top Cars

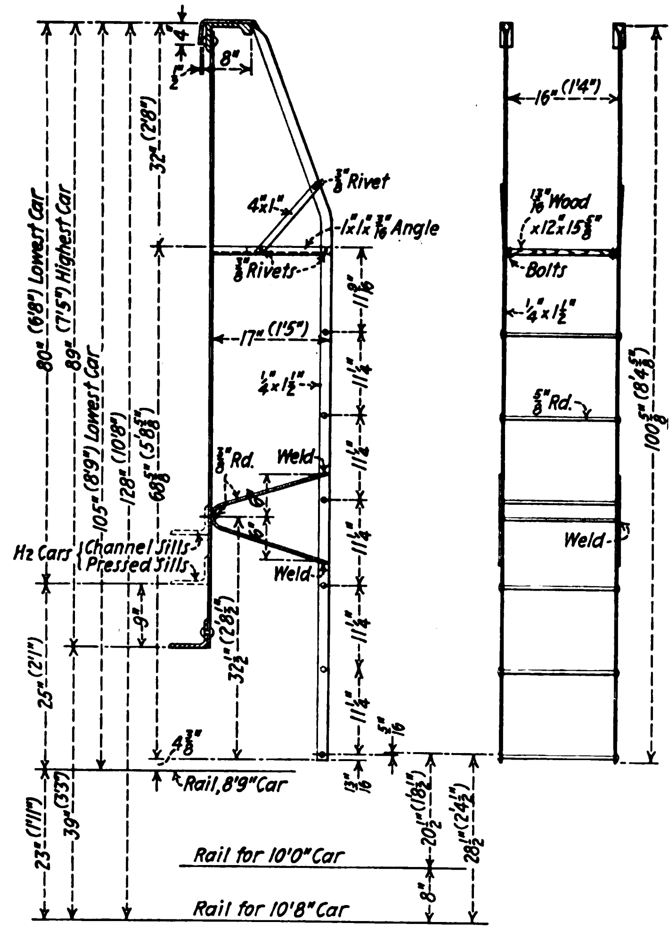
THE safety ladder shown in the two illustrations was designed by Guy M. Gray, superintendent of motive power, Bessemer & Lake Erie, to reduce the hazard for men engaged in trimming or in loosening coal, ore, slag, etc., in open-top cars so that the lading will fall through the hopper doors. There is always the possibility for a man engaged in such work of falling off or into the car, or being buried under a slide.

The ladder is easy to handle, weighing but 42 lb. It can be slung over the side of a car at any location along



This ladder ensures safety to the workman trimming cars at coal tipples

the sides or ends. The stiles of the ladder are 1/4-in. by 1 1/2-in. bar stock. The rungs are made from 5/8-in. round bar. They are secured to the stiles by heading over each end of the rung with a rivet hammer. The ends of the 5/8-in. bar are turned down to 3/8 in. diameter and inserted in 7/16-in. holes in the stiles spaced 11 1/4 in.



Safety ladder used on the Bessemer

apart. The ladder is held straight against the side of the car by the step and bracket support, as shown.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Tank-Head Damage Caused by Previous Fracture

On March 19, 1929, the tank head at the B end of the Union Tank Line Company's car 49210 was broken while being switched on the Michigan Central at Detroit, Mich. The fracture of the tank head was 56 in. in length and opened outward. The car owner stated that the car had been in service five years without the renewal of the tank head in question, and that nine months prior to the accident the tank had been properly tested by the application of 60 lbs. hydrostatic pressure without any distress. The owner contended that this test proved that the car was in safe condition for ordinary handling and maintained that since the tank head burst it was the result of improper handling The Michigan Central produced a section of the tank head showing that an old defect had existed in the head and that it was directly responsible for the final failure.

In rendering its decision the Arbitration Committee stated: "The final failure of this tank head developed from a previous fracture in same. Car owner is responsible."—*Case No. 1661—Union Tank Car Company vs. Michigan Central.*

Renewal of Auxiliary Gasket Within Air-Brake Cleaning Date

On October 10, 1928, the Great Northern cleaned the air brakes on Union Pacific car 72123 on account of a worn-out auxiliary gasket. The brakes had been cleaned 113 days prior to the renewal of the gasket by the Great Northern. The U. P. contended that the principle of Interpretation 2, of Rule 60 indicates that if a definite defective condition can be corrected by the renewal of a defective auxiliary gasket, the renewal of this gasket does not in itself warrant the attention specified for cars requiring annual repairs of air brakes. The Great Northern did not deny that the air brakes were cleaned solely on account of the auxiliary gasket, but contended that Interpretation 2 of Rule 60 would specifically mention this gasket if it was the intent of the rules that the renewal of a defective cylinder gasket in itself does not justify the attention specified for cars requiring annual repairs within nine months.

Following is the decision as rendered by the Arbitration Committee: "The contention of the Union Pacific is sustained."—*Case No. 1662—Union Pacific vs. Great Northern.*

Betterment Charge For Loose Wheels Removed By Owner

The Pacific Fruit Express Company presented a joint evidence statement dated September 12, 1929, for one loose wheel on its car 36562, the wheels having previously been applied by the Chicago, Burlington & Quincy on January 30, 1929. The C. B. & Q. issued a defect card under its understanding of the provisions of Rule 81 as modified in Supplement No. 1 to the 1929 Code and marked it "Labor only." The owner protested the wording of the defect card at the time it was received from the C. B. & Q., claiming that the words "Labor only" should not have been written on it. There was no claim that the wheel in question was defective or to be scrapped for any cause. The owner contended that it was entitled to material as well as labor, namely, the difference in value between new wheels applied and secondhand wheels removed. The C. B. & Q. questioned the charge for new less secondhand wheels, inasmuch as the wheels removed from the owner's car, and replaced by new wheels, were secondhand wheels. The labor charges for changing the wheels was not disputed.

The decision as rendered by the Arbitration Committee is as follows: "The defect card cannot be restricted to cover labor only, in view of the principle of Rule 65. In this connection, however, where repairs are made by the car owner on authority of defect card, no charge shall be made for the difference in value be-

tween new wheels applied and secondhand wheels removed, in view of the principle of Rule 98, Section (b), Paragraph (7)."—*Case No. 1663—Chicago, Burlington & Quincy vs. Pacific Fruit Express Company.*

Car Reported Damaged Under Rule 120——Date Correct

On June 22, 1928, the Chicago, Milwaukee, St. Paul & Pacific flat car 68087 failed in ordinary handling while being moved in Missouri-Kansas-Texas train No. 72 at Paola, Kansas. On June 30, 1928, the car was reported to the owners under A.R.A. Rule 120 at which time they were furnished a joint inspection certificate showing the defects existing on the car as well as the circumstances under which the failure of the car developed. On July 5, 1928, the owners requested further information as to how the damage developed and, at the same time, called attention to the fact that the report furnished by the M-K-T on June 30, referred to A.R.A. Rule 112 as well as A.R.A. Rules 120 and 44. In reply the M-K-T advised the owners that the reference to A.R.A. Rule 112 in the original report of June 30, was the result of a typographical error and should have read Rule 120. On July 26, 1928, the owner authorized the dismantling of the car at their expense. This was done and the owner was authorized to render a bill against the M-K-T to cover the value of the salvage recovered. However, the question as to the date that per diem should cease was not settled. The C.M. St. P.&P. contended that per diem should not cease until July 10, 1928, contending that the information furnished in the M-K-T letter of June 30, was not sufficient to enable them to determine responsibility for the damage. It was contended by the M-K-T that per diem should cease June 30, 1928.

The decision as rendered by the Arbitration Committee follows: "The circumstances covering failure of this car as contained in report of handling line dated June 30, 1928, were sufficient to establish the responsibility of car owner in accordance with Rules 44 and 120, notwithstanding unintentional reference to Rule 112 in same letter. Therefore, the car was correctly reported under Rule 120 as of June 30, 1928".—*Case No. 1665—Chicago, Milwaukee, St. Paul & Pacific vs. Missouri-Kansas-Texas.*

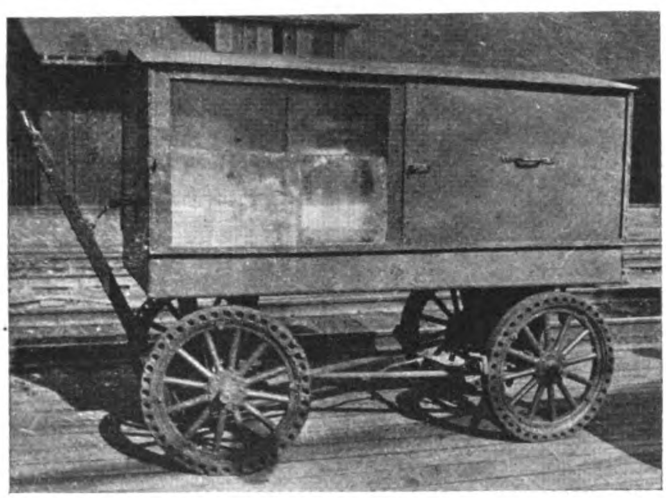
Defective Card Claimed To Be Issued Improperly

On October 16, 1929, the Empire Oil & Refining Company's tank car No. 667, arrived at the Cushing, Okla., plant of the owners carrying a defect card issued by the Pueblo Joint Interchange Bureau against the Denver & Rio Grande Western covering: One tank head bent in, one buffer block bent and broken, two center sills bent, one hand rail bent, one tank band anchor-casting wheel cut, one tank band-wheel cut, one center-sill bottom cover plate bent up, and auxiliary-reservoir bracket bent; all on account derailment. At the request of the owner and before responsibility for the damage was agreed upon, the car was billed home for repairs. Repairs were made by the car owner and the bill in the amount of $264.24 was rendered against the D. & R. G. W. on the authority of the defect card issued at Pueblo. The tank car was damaged when the brakes on the train in which the tank car was moving went into emergency as a result of couplers passing between the second head-end engine and the first car of the train. The damaged car ERIX 667 was the forty-eighth car from the head end. The impact broke the adjacent couplers on car ERIX 667 and the New York Central car 342091, leaving no protection between the two cars, since the end sill on the N.Y.C. car was almost flush with the end of the car and ERIX car 667 had no end sill. The trucks were driven under the ERIX car and the end of the car sagged downward and outward coming in contact with the metal end sill of the N.Y.C. car causing the above damage. The handling line stated that no cars were derailed or telescoped but all damage was the result of the emergency application of the brakes. For this reason the D. & R. G. W. contended that the damage was the owner's responsibility, that the defect card granted by the Chief Joint Interchange inspector at Pueblo was issued in error because he was not in possession of the facts as to the manner in which the car was damaged, and that the car was not damaged or derailed or subjected to other unfair usage that might be considered handling line responsibility under A.R.A. Rule 32. For these reasons the handling line declined to pay the bill rendered on the authority of the defect card.

In rendering its decision the Arbitration Committee stated: "The issuance of a defect card by an authorized representative of a railroad is an acknowledgment of responsibility by the company issuing same which cannot be repudiated and leaves no grounds for arbitration by this Committee. The principles of Decisions 1235, 1373, 1398, 1472, 1571 and 1655 apply".—*Case No. 1664—Empire Oil & Refining Company vs. Denver & Rio Grande Western.*

Noiseless Truck for Icing Passenger Cars

To eliminate complaints against the noise made by car men while icing passenger cars due to the rumbling of the wheels of the conventional baggage trucks in and about passenger stations a progressive passenger-car foreman designed the icing truck shown in the illustration.



Four solid-tired automobile wheels on roller bearings make this icing truck noiseless and easy to handle

Two front axles and four front wheels of the Ford car type equipped with solid rubber tires are easily obtainable from any automobile scrap yard and in many instances can be secured from the scrap pile in the railroad yard. By connecting the spindles of the front wheels to the spindle of the opposite wheel on the rear

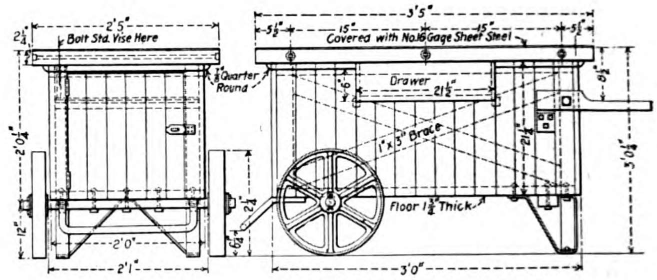
of the truck it can be made to turn in a comparatively small space. Roller bearings make it possible for one man to handle the truck with ease.

The body, if electrically welded, can be made leak-proof. A wooden slat bottom will keep the ice from contact with the water in the bottom of the truck. For sanitary reasons the slat bottom should be removable. A 3/8-in. drain cock, located in the bottom of the body, at the rear, will permit the draining of water when desired.

The truck shown in the illustration has been equipped with a brake. The brake is attached to the tongue and becomes effective as soon as the tongue is raised. The brake is then effective as long as the tongue is hooked up and eliminates the necessity of chocking the wheels when the truck is left on grades or inclines.

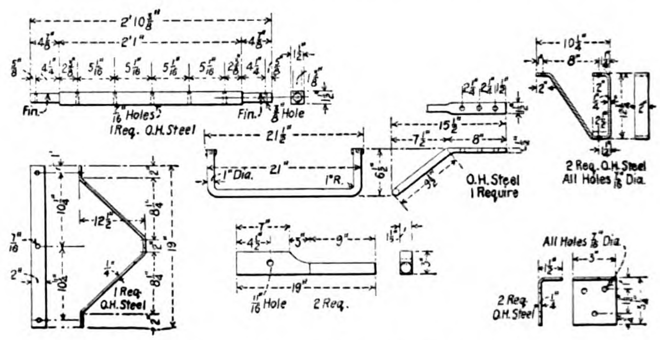
Portable Work Bench For the Car Department

CARPENTERS, pipe fitters and other craftsmen employed in making repairs to coaches and box cars frequently have to work in various parts of the shop and require a considerable number of tools and a bench on which to work. The portable bench shown in the two drawings was designed to meet such requirements. It is carried on two 24-in. cast-iron wheels. Legs of forged steel are provided at the rear end. The top is covered with No. 16 gage sheet steel. Bolt holes are provided near the rear end of the bench for a vise.



Portable work bench for the coach and box-car repair shops

A drawer 6 in. deep by 21½ in. wide is provided for small tools and equipment. The remaining space underneath the bench is enclosed and used for a locker.

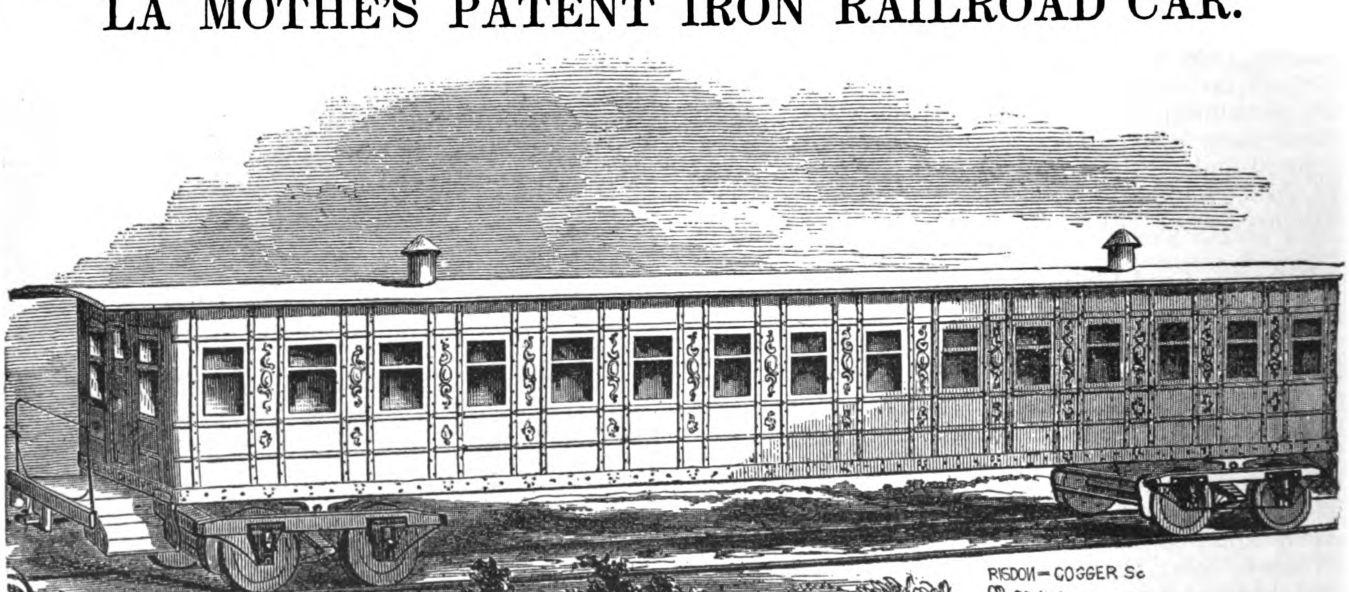


Details of the portable work bench

The door to the locker is located at the front end as shown, and is provided with a hasp for a padlock.

* * *

LA MOTHE'S PATENT IRON RAILROAD CAR.



WE are now prepared to furnish this Car to railroad companies at short notice and reasonable rates.

Notwithstanding its extraordinary advantages, the prices will be arranged wholly with reference to the cost of construction—without regard to patent rights.

We are now building passenger and freight cars for several companies; and it is desirable that parties ordering give early notice of their wants.

The striking features of this principle are:—simplicity—cheapness—durability—superior safety in cases of accident—facility of repairing when damaged—and less weight compared with the wooden cars of the same capacity; these cars for 60 passengers are more than two tons lighter than the ordinary cars, while the strength is immeasurably greater.

We guarantee these points in the acceptance of orders.

The advantages may be tested by personal observation in this city. Detailed descriptions of the cars will be forwarded to parties wishing them.

ALFRED SEARS,
Civil Engineer and Architect,
Agent.
OFFICE—9 SPRUCE ST., NEW YORK.

An ultra-modern passenger car as advertised in the *American Railroad Journal* in 1855

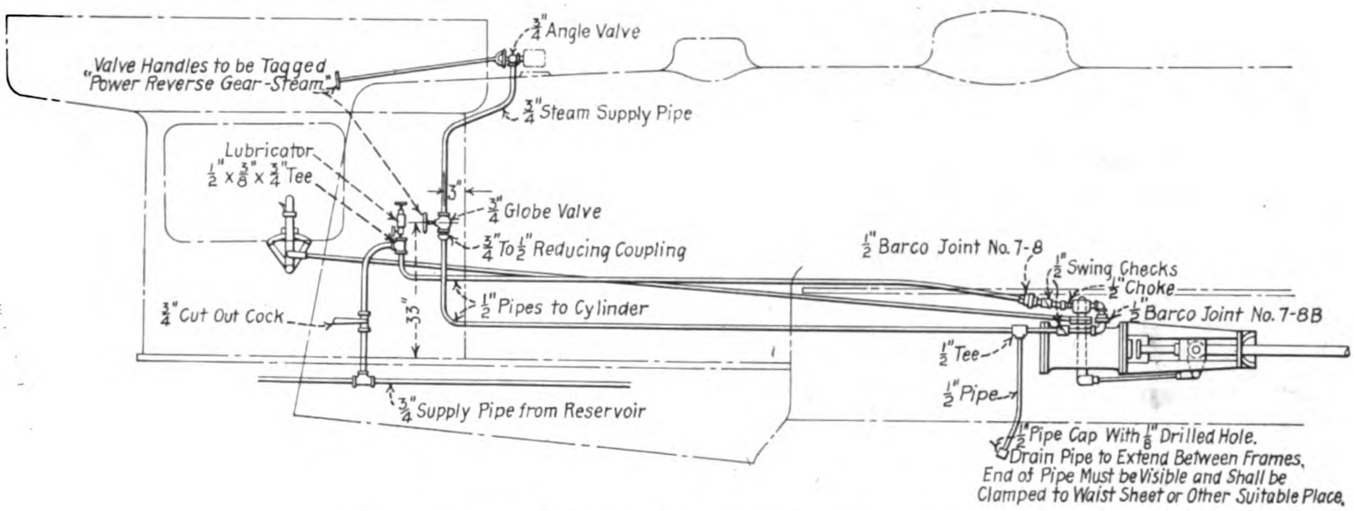
In the

Back Shop and Enginehouse

Piping Locomotives For Power-Reverse Gears

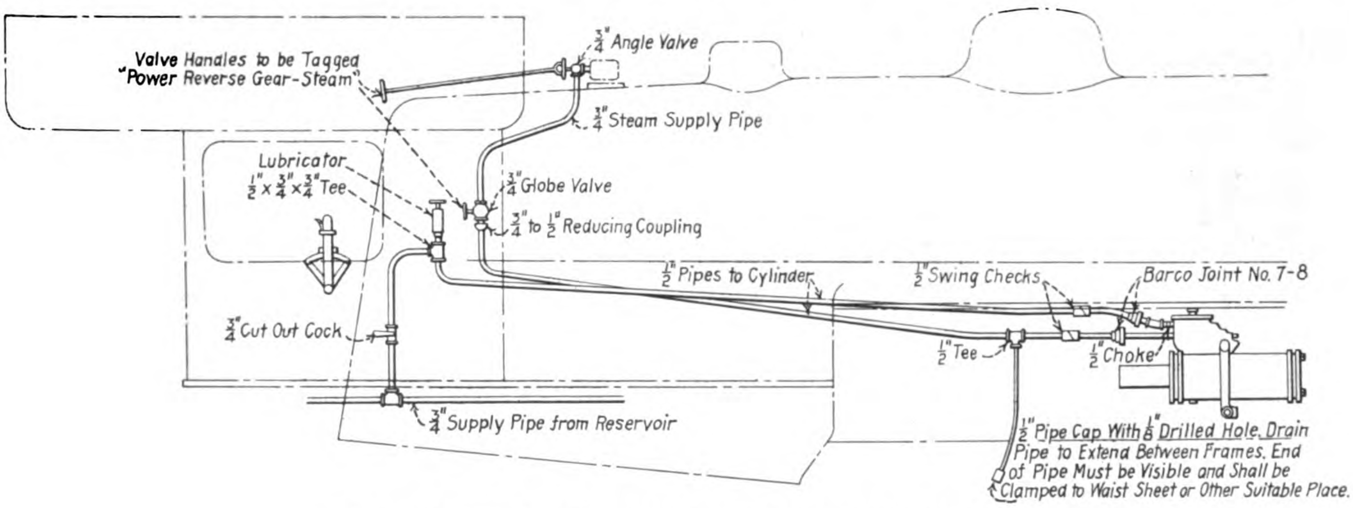
THE piping diagrams for the various types of power-reverse gears shown in the drawing have been followed for a number of years by an eastern railroad in the application of gears to its locomotives. The principal feature of these piping applications is safety. It is possible, with this arrangement of piping, to operate the gear by air or steam, although on this road all gears are applied for air operation. However, in case the air line is broken or becomes inoperative, the engineman can, by manipulating several valves, change the gear to steam operation. The general scheme of piping arrangement is applicable to all power-reverse gears in addition to those shown in the four drawings showing the piping diagrams.

Referring to the piping diagram of the Barco Type B-3 power-reverse gear, the engineman closes the ¾-in. cut-out cock in the air supply pipe and opens the ¾-in. angle valve at the steam turret by turning the extension-valve handle in the cab. He also opens the ¾-in. globe valve, which is located further down the side of the boiler in the cab. Both of these steam valves are tagged "power-reverse gear-steam". Directly connected to the ¾-in. globe valve in the steam line, through a ¾-in. to ½-in. reducing coupling, is a ½-in. supply pipe to the cylinder of the power-reverse gear. A ½-in. drain pipe is connected to the steam line as shown in the drawing.



Piping diagram for the Alco Type E power-reverse gear

A ½-in. choke, shown in one of the drawings, is inserted in the air line to the cylinder of the power-reverse gear. This choke permits adequate building up of the steam pressure in the valve chamber when the gear is being operated by steam and the compressed air is shut off. The two drawings showing the choke also show the steam- and air-inlet connections to the cylin-



Piping diagram for the Barco Type B-3 power-reverse gear

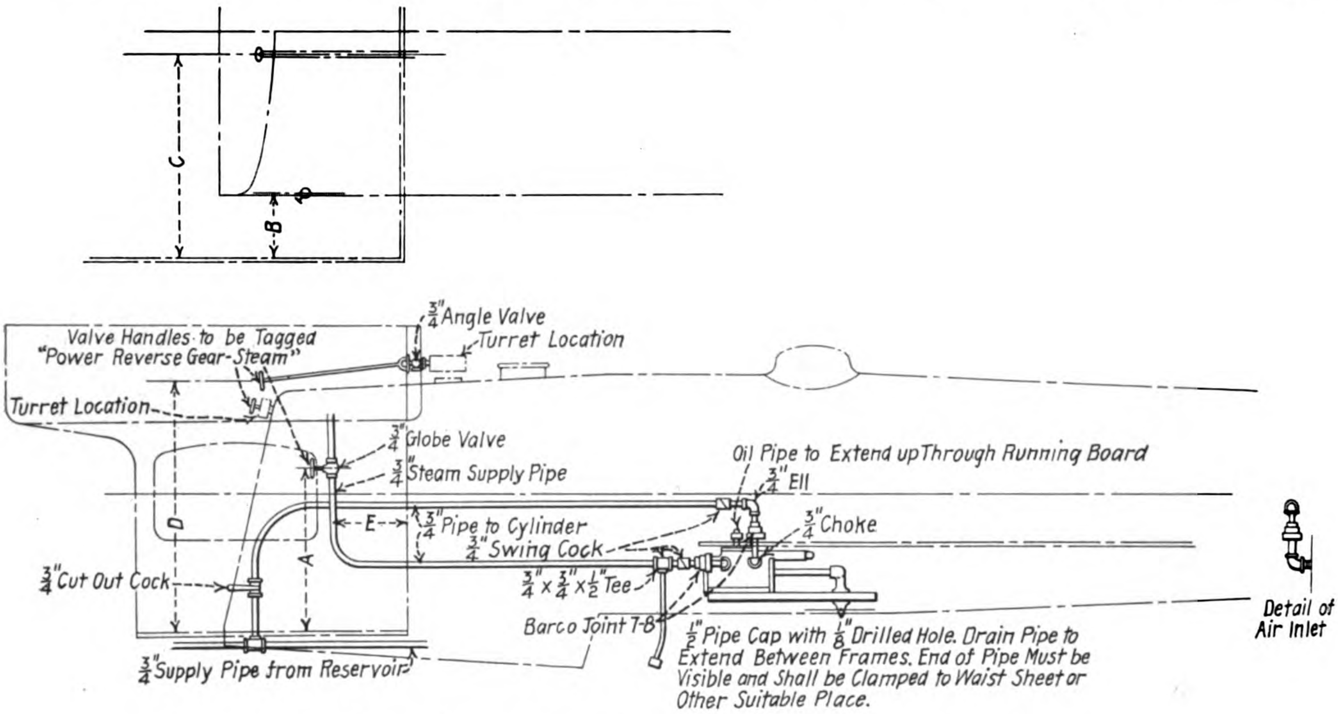
der of the reverse gear and the location of the choke nipple.

The piping diagram for the Barco Type B-4 power-reverse gear is similar to that of the Type B-3. However, ¾-in. steam- and air-line connections are used which eliminates, of course, the ¾-in. to ½-in. reducing coupling at the globe valve in the cab.

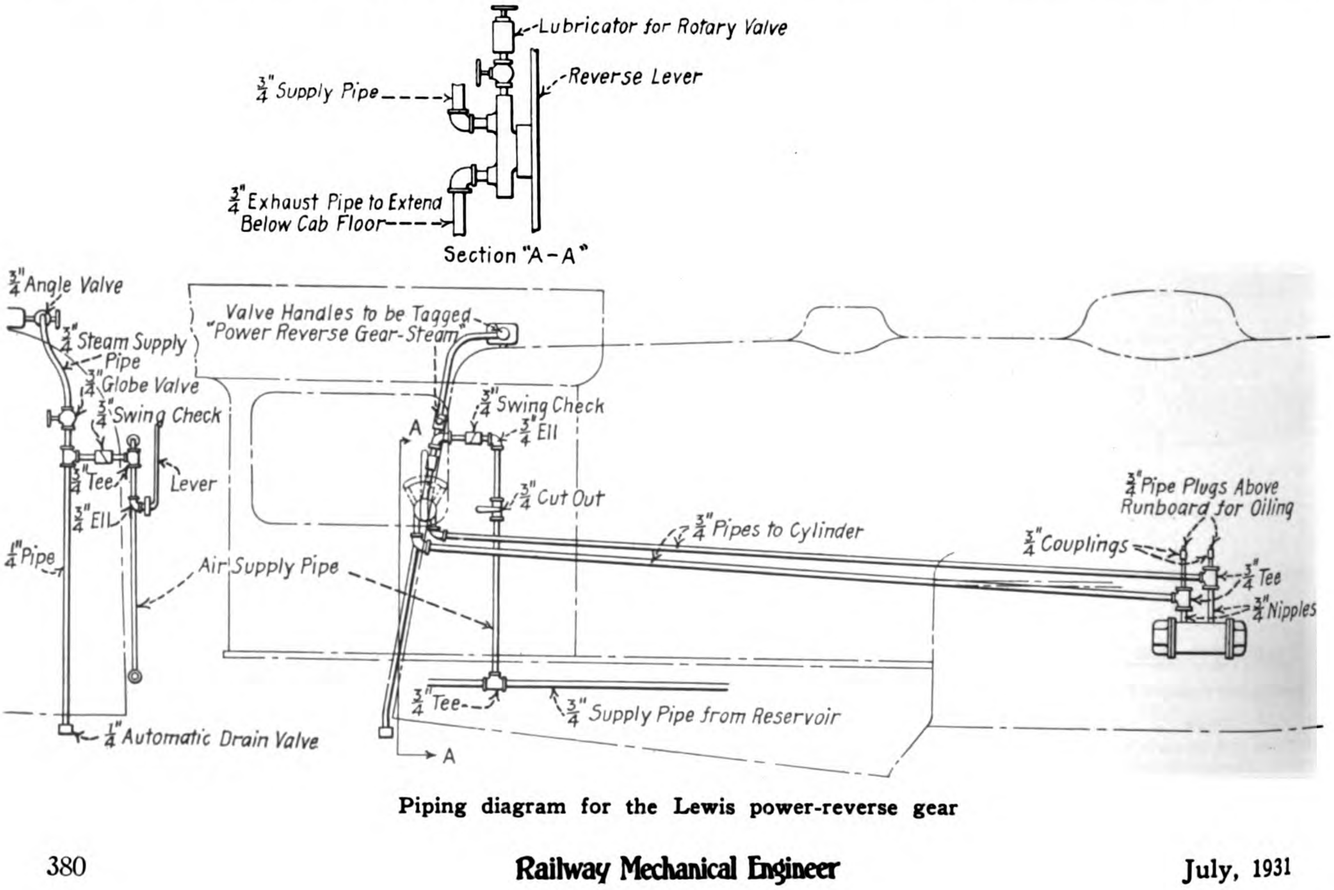
One-half-inch steam and air lines are used in the installation of the Alco Type E power-reverse gear. Swing checks are inserted in both the steam and air lines for the application of the Alco gear as in the Barco installation just described.

The Ragonnet Type A piping application diagram calls for ¾-in. steam and air lines while the Type B has ½ in. The oil pipes to the cylinder, in the case of power-reverse gears which are applied to the side of the boiler, extend up through the running board.

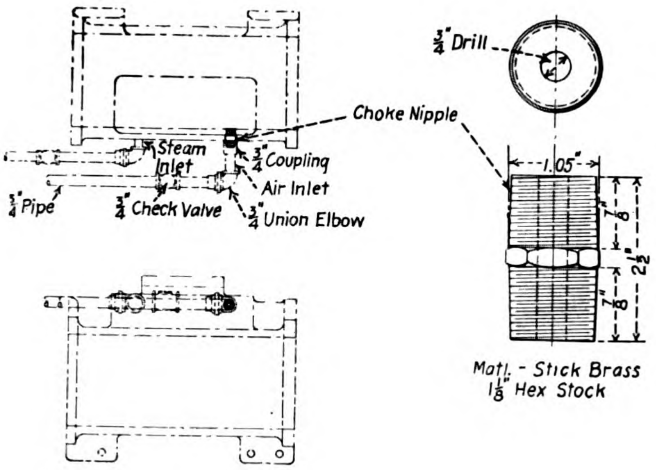
The piping diagram for the Lewis power-reverse gear calls for ¾-in. steam and air lines. The swing check is inserted in the connection between the steam



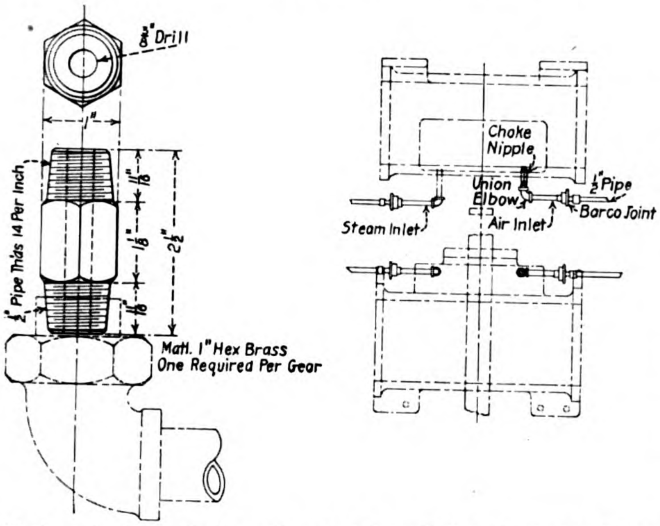
Piping diagram for the Ragonnet Type A power-reverse gear



Piping diagram for the Lewis power-reverse gear



Choke nipple applied in the air inlet of the Ragonnet Type A and the Barco Type B-4 power-reverse gears



Choke nipple applied in the air inlet of the Ragonnet Type B; Alco Type E and Barco Type B-3 reverse gears

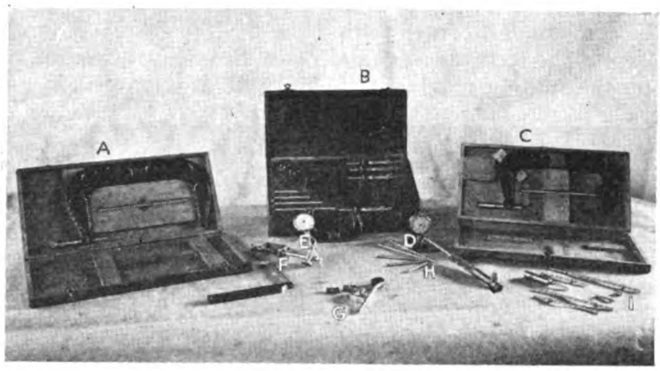
and air lines. A choke nipple is not reqired in this application on account of the small size of the cylinder, 8 in. by 18 in. All pipes and fittings used in this application are extra heavy.

Precision Tools Required In Rail-Car Maintenance

By E. O. Whitfield

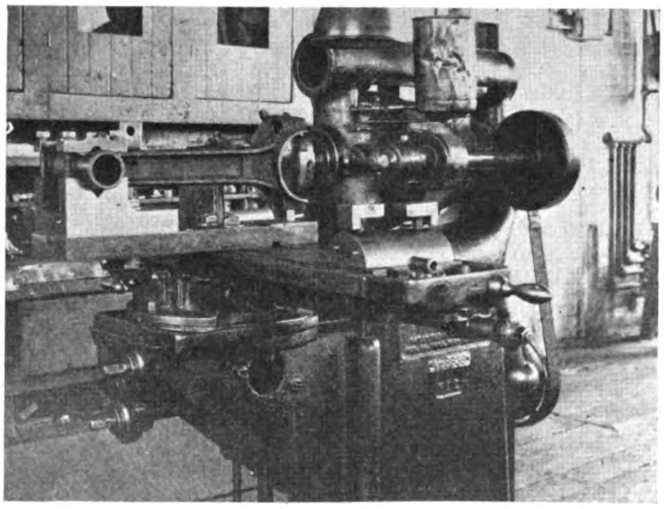
GOOD precision tools, such as micrometers, gages, indicators, special fixtures, etc., are essential to efficient rail-motor-car maintenance. Of greater necessity is having the men expert in the use of precision tools and proficient in work which requires a high degree of accuracy.

The operation shown on the milling machine is that of facing off a connecting-rod shell. The connecting rod is held in position with a fixture which consists essentially



Precision tools used in the general overhaul of rail-motor cars

of a V-block and clamp. The boring operation is also handled on this machine, but with a different cutter. Accuracy is possible with this fixture and is a considerable time saver as compared with scraping by hand. The fix-



Facing off a connecting-rod shell on a milling machine

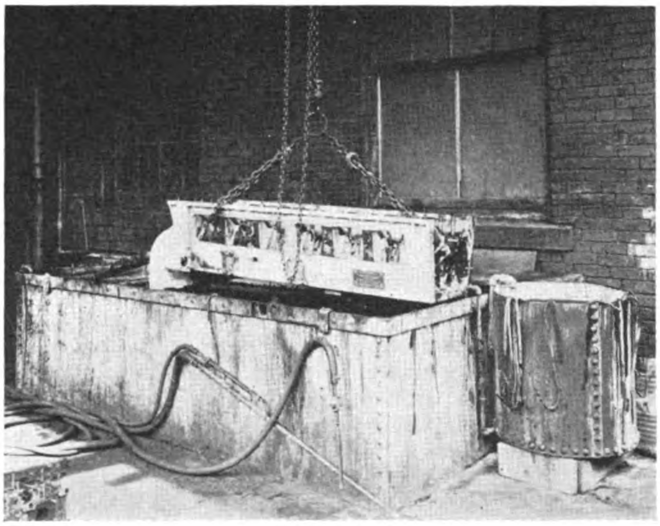
tures and cutters were made in the tool room of the locomotive repair shop.

The detail parts of this fixture are shown in another illustration, and also the tools used for boring and facin connecting rods. *A* is the rod- and cap-facing fixture; *B*, rod-boring fixture; *C* and *D*, clamps for hold-

Detail parts of the fixture for facing off connecting-rod shells

ing the cap in the fixture; *E*, 4-in. outside micrometer; *F*, arbor and adjustable-boring cutter; *G*, adjustable boring cutter for small connecting-rod ends; H, indicator attaching clamp; *I*, indicator flexible attachment and *J*, an indicator. These fixtures and tools are used for truing connecting rods and cap faces, as well as for boring bearings and rods.

The fixture *A*, which is shown on the milling machine, is used with the cutter *F* shown for facing the main-rod bearing shell down to within the desired distance of the caps. The fixtures *B*, *C* and *D* are also shown assembled on the milling machine. The shells are clamped in position and faced flush to the rod. The small clamps *C* and *D* are used for holding the main bearing caps in position while facing the shells.



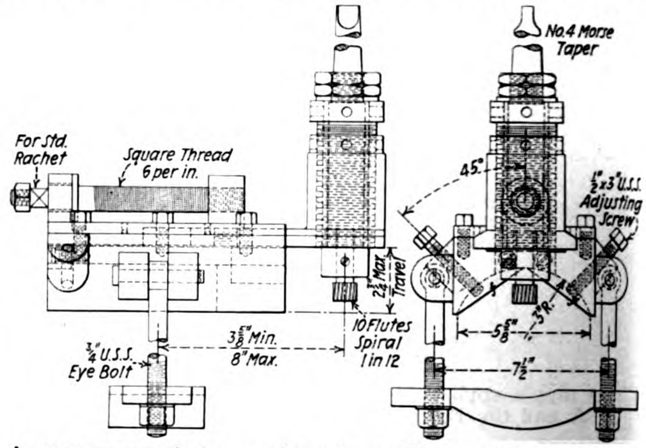
Cleaning tank where all parts are thoroughly cleaned before going into the shop

Shown in another illustration are various micrometers, indicators and precision instruments used in rail-car maintenance work. *A*, *B* and *C* are micrometers and test bars; *D* and *H* are cylinder gages; *E* and *F* are universal indicators; *G* is a speed indicator and *I* is a set of inside micrometers.

A thorough cleaning of all parts previous to being routed through the shop is essential to accurate work. The solution used in the vat shown is Multi-Oakite. This solution will not injure babbitt, or aluminum. It is heated by a steam coil and agitated by air from the bottom. Small parts are hung on hooks or placed in buckets having perforated bottoms. Large parts are lowered into the vat as shown. Sludge which may still remain in the corners is removed with a combination of the solution and steam applied by means of the double hose and long nozzle shown in the foreground. All parts are rinsed with clear water after cleaning.

Machine for Cutting Crank-Pin Keyways

In some shops and engine terminals it is desirable at times to have a machine which can be bolted directly on the crank pin for milling keyways. A device which is designed especially for this purpose is shown in the drawing. This keyway milling machine consists of a steel base fitted with two eye-bolts and a yoke for bolting the machine to the crank pin. The base is fitted with a cast-steel slide, the end of which is bossed and threaded for the insertion of a brass bushing in which the spindle and milling cutter revolves. The milling cutter, with 10 flutes, is held in the spindle by means of a 3/8-in. set

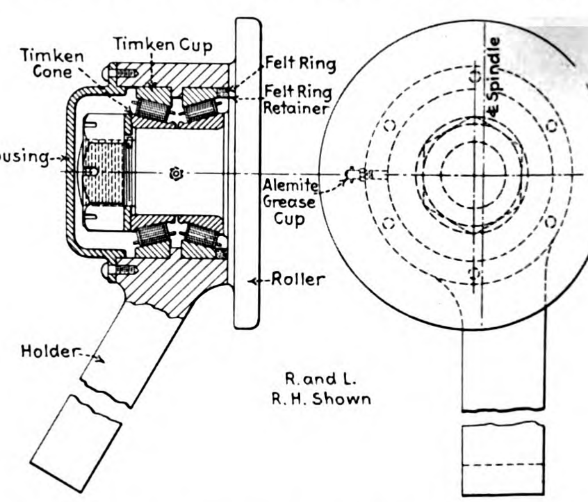


Arrangement of the machine for milling crank-pin keyways

screw. The spindle shank is of No. 4 Morse taper for the application of an air motor. The slide is fed into the cut by means of a feed screw fitted with six square threads per inch. It is fed manually by means of a ratchet wrench. Maximum travel of slide is 4 3/8 in.

Journal Roller for Driving-Wheel Axles

A driving wheel journal roller fitted with Timken roller bearings is shown in the drawing. The roller and integral shaft, on which is pressed the roller-bearing cone, is held in the housing by means of a castellated nut. The roller bearings are grease lubricated, and the housing is fitted with Alemite grease cups for applying

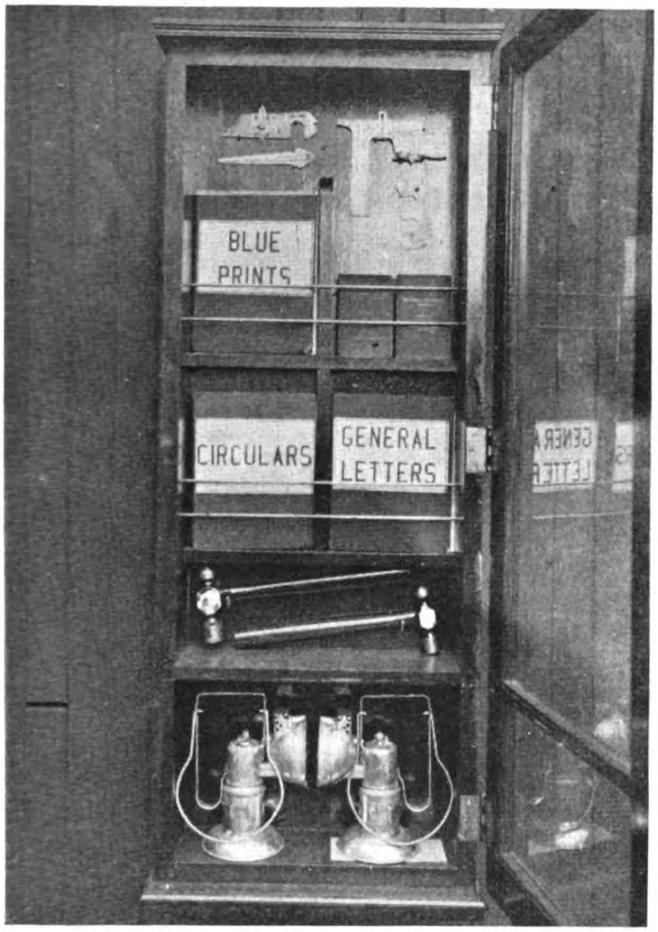


Driving-wheel journal roller fitted with Timken roller bearings

the grease. The felt ring container set between the roller-bearing cup and the roller eliminates the grease from seeping out of the housing. The roller is placed off center as shown in the drawing. It is made in both right-hand and left-hand styles since the holder is set obliquely to the roller wheel. The application of roller bearings has been made to secure a tool which will render satisfactory service for a long period of time.

Locomotive Inspection-Pit Equipment

INSPECTORS located at the inbound locomotive inspection pit must be furnished with the proper tools and instructions. A cabinet containing various gages and other equipment, if located in the inspectors quarters at the pit, will meet with the approval of the inspectors themselves as well as the rest of the local supervisors. General letters, circulars and blue prints with which the inspectors must be familiar, together with copies of the I.C.C. Manual of Locomotive Inspection, can be kept in plain view and are easily accessible to the inspectors and others whose duty it may be to review these instructions from time to time.



A cabinet of this kind keeps the inspector's working tools where he can find them

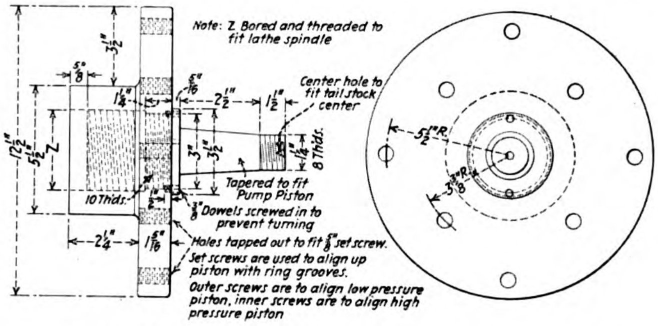
Arbor for Turning Compressor Air Pistons

By E. G. Jones

THE arbor shown in the sketch is made for turning 8½-in. compressor air pistons. Often an air piston has to be turned to fit the pump cylinders and it is a difficult feat to accomplish without the aid of a fixture.

There are many methods used in various shops for accomplishing this. Each one of them gives trouble in properly aligning the ring grooves in turning. If the alining is not properly done, when the ring grooves are cut deeper in the piston, the lathe tool will cause a wide ring groove to be cut which will, of course, condemn the piston.

This arbor overcomes this difficulty in that set screws are applied in the holes tapped for the screws and after the piston has been placed on the arbor it is properly alined by means of the set screws. There are two sets of holes in the arbor. The ones on the smaller radius



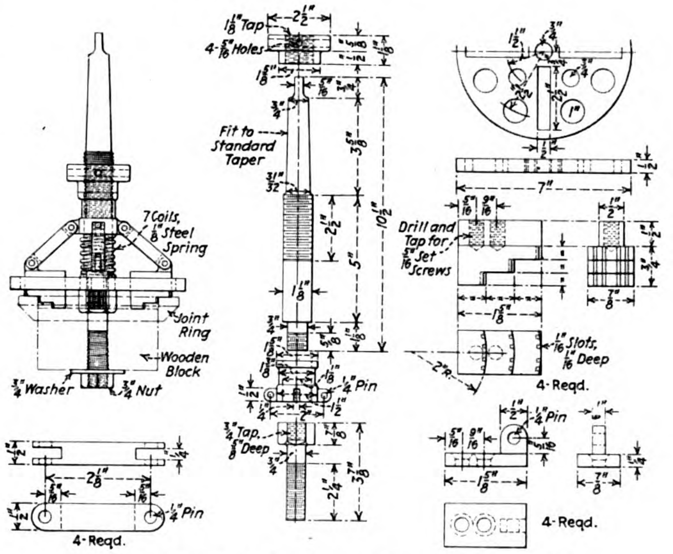
Arbor for turning 8½-in. compressor air pistons

are used for alining the high-pressure pistons, while the ones on the larger radius are for alining the low-pressure pistons. When the proper alinement is made, the nut on the tapered fit of the arbor is made tight and the piston turned.

The base or body of the arbor is made of cast iron and threaded in the large bore to fit the lathe spindle. The tapered piston fit is made of steel and is screwed into the cast-iron body and doweled with ⅜-in. pins to prevent turning at any time. A similar arbor may be made for 9½-in. air pistons.

Chuck for Holding Grinding Blocks

THE usual procedure of placing steam-pipe joints on tapered wooden blocks for grinding the seats is often unsatisfactory from the operator's standpoint, especially when the block becomes badly worn and the ring slips. To overcome the difficulty of having the joint



A chuck for holding joint rings when grinding steam-pipe joints

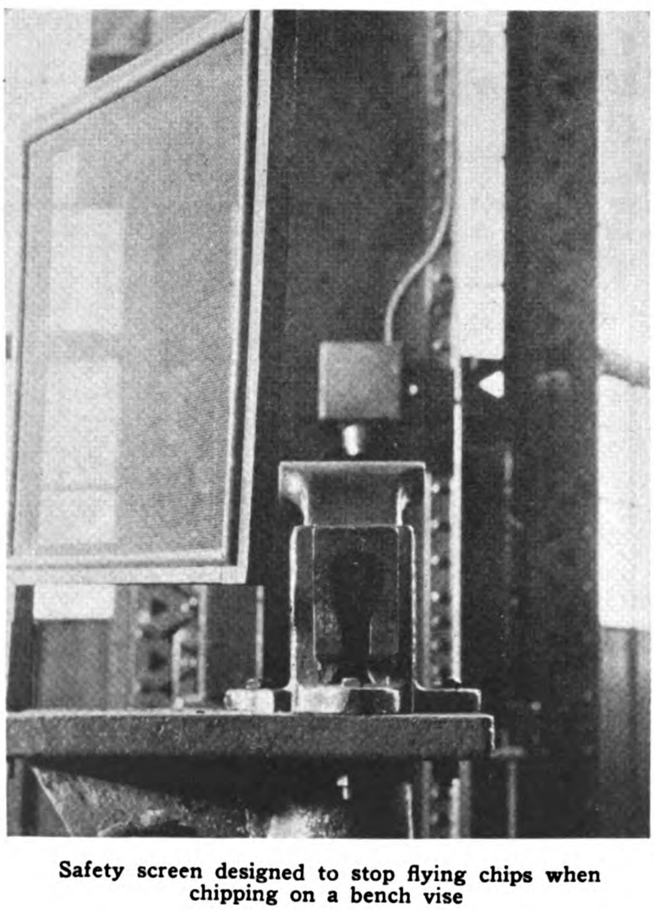
ring off center on the block as a result of this slipping, the chuck shown in the drawing has been designed on one railroad for holding the joint ring while grinding. The chuck consists of a spindle and a chuck which is locked at one end by a special jamb nut and at the other by an adjusting nut which controls the opening and closing of the chuck jaws. A seven-coil 1/8-in. steel spring is placed on the spindle immediately behind the chuck to serve as the tension member which holds the chuck jaws out against the joint ring as it is compressed by the adjusting nut. The special jamb nut which holds the chuck against the spindle is 3 7/8 in. in overall length and serves to hold a straight-side wooden block on the end of the spindle. The wooden block is used only to guide the joint ring on its seat as it is being ground.

When in use the correct size block is chosen for the joint ring which is to be ground. The ring is placed over one end of the block, leaving a portion of the ring to serve as a grip for the chuck jaw. The adjusting nut which controls the movement of the chuck jaws is loosened sufficiently to permit the insertion of the stepped teeth on the jaws inside the joint ring. The tightening of the adjusting nut forces the chuck jaws outward, securely holding the joint ring and the block.

Safety Screen When Chipping on a Vise

By "Safety First"

"DON'T chip toward the gangway" is a sign frequently seen in shops and enginehouses. But in spite of precautions chips fly about which occasionally land in someone's eye. The handy vise chipping screen illustrated is arranged somewhat like a flag. The mast is inserted in a 3/8-in hole in the vise bench. This permits considerable adjustment by swinging the screen around, and it may be instantly removed from the vise stand when not in use.



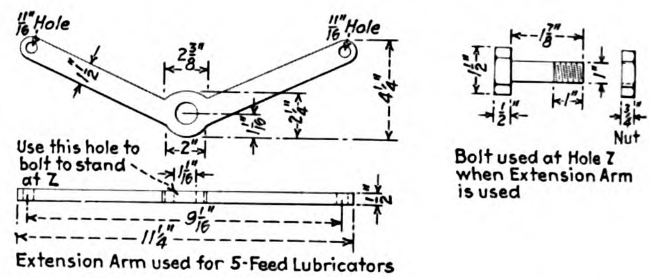
Safety screen designed to stop flying chips when chipping on a bench vise

While on the subject of chips it might be mentioned that there is opportunity for considerable ingenuity in designing sheet-metal chip guards for planers, shapers and other machine tools. When taking a heavy cut in brass a planer will scatter chips far and wide. By attaching a properly bent piece of sheet metal to the tool holder it is possible to catch most of the chips.

Repair Stand for Hydrostatic Lubricators

By E. G. Jones

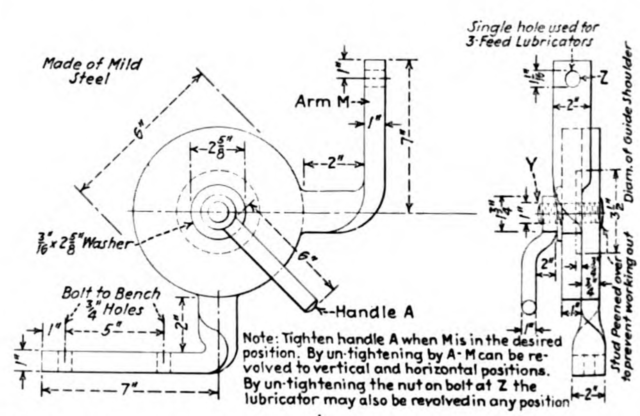
THE repair stand for hydrostatic lubricators, shown in the two sketches, has proved useful in the air-brake department where lubricators are repaired. In many shops these lubricators are repaired while held rigid



Extension arm used for five-feed hydrostatic lubricators

in a bench vise. This is undesirable as the lubricator must be removed and revolved to various positions during the progress of the work.

The repair stand shown can be used for three- and five-feed lubricators. When a five-feed lubricator is to be repaired, the extension arm is applied to the stand and removed when a three-feed lubricator is to be repaired.



Horizontal and vertical work stand for hydrostatic lubricators

This is because of the different design of holding studs for the two lubricators. The lubricator may be revolved about *Z* so as to allow the feed units to be on top for easy removal or replacement. It may also be revolved about the stud *Y* so as to have the "eyes" or windows of the lubricator on top for removal or replacement.

NEW DEVICES

Niles Locomotive Axle Journal Grinder

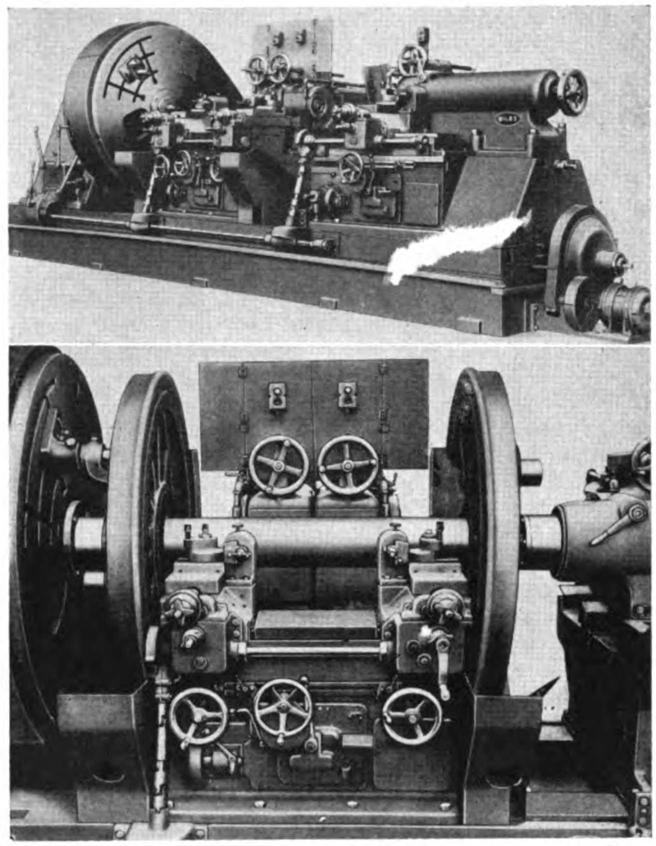
SIMULTANEOUSLY with the announcement by the Niles Tool Works Company, Division General Machinery Corporation, Hamilton, Ohio that it was manufacturing a machine for grinding locomotive axle journals, the March issue of the *Railway Mechanical Engineer* contained a brief statement of the salient features of the machine on page 154. Elaborating the above announcement is the following complete description of this device:

The machine is arranged with two grinder heads to grind simultaneously two inside journals up to 18 in. in length, and it is provided with two independently operated tool rests for facing the hub liners or turning the journals. The swing over the bed is 90 in.; the maximum distance between centers 10 ft. 0 in.; the face plate diameter 72 in.; and the face plate speeds 10 to 30 r.p.m.

Grinding Unit for Inside Journals

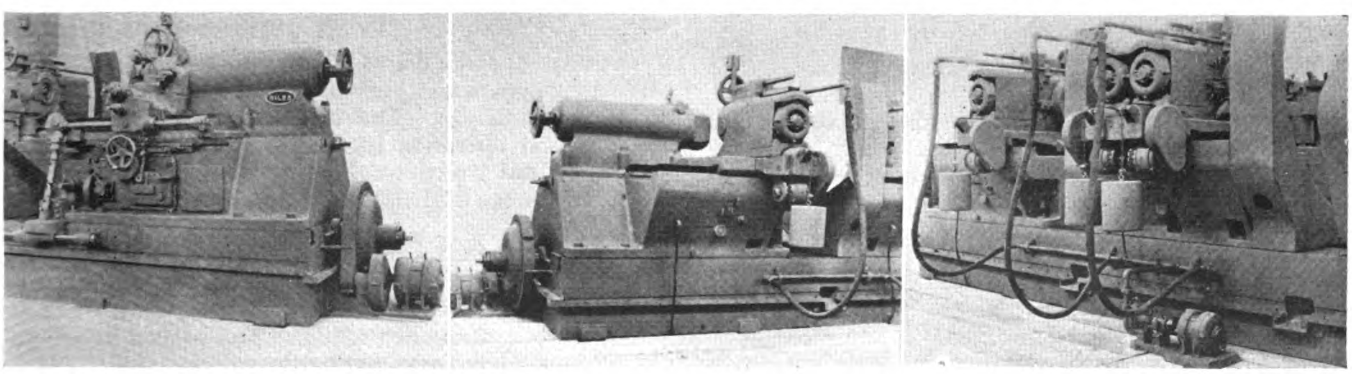
This unit is mounted on the main bed. It consists of a heavy base casting with the grinding heads mounted at the rear, the carriages for turning mounted at the front, and the power mechanism for reciprocating the grinding heads built directly into the base. The grinding head unit consists of a sub-base and two grinding heads each fitted with a grinding wheel and independent power driving means for each wheel. The heads are provided with lateral adjustment so as to allow them to be set up to grind journals of from 12 in. to 18 in. in length without over-travel of the wheel for the different length journals. The sub-base is fitted and gibbed to V-ways on the base for lateral movement to the grinding wheels, and each grinding head is fitted and gibbed to V-ways for an in-and-out movement of the grinding wheels.

The grinding wheels are of a diameter as large as operating conditions will permit. Each wheel is driven by a 12-hp. motor through gearing to the spindle. The spindle and all drive shafts revolve in anti-friction bearings. The grinding heads move laterally on the bed through rack and pinion, the reciprocating movement being obtained through a reversing mechanism (as furnished by the Cincinnati Grinder Company) which is mounted on the front face of the base. This mechanism is operated through a 1-hp. motor mounted in the base. Each head is fitted with quick in-and-out traverse through an independent 1-hp. motor. Hand micrometer in-and-out movement is also provided through a large hand wheel. All electric control stations and operating mechanisms are conveniently located for the operator so as to speed up production.



Top: General view of the Niles locomotive-axle journal-grinding machine—Bottom: The journal-grinding units

The two carriages for turning the journals are fitted and gibbed to V-ways at the front section of the base. Compound tool rests are fitted and gibbed to V-ways on the carriage for in-and-out movement. The carriages are provided with power longitudinal feed for turn-



Left: A front view of the tailstock arranged with grinding and cutting attachment—Center: The rear of the tailstock—Right: A rear view of the grinder-head drive motors, power-traversing motors and the fluid pump and fluid distribution system

ing journals and power cross feed for facing hub liners, the feeds being engaged and disengaged both for cut-out and direction, at the tool rest. The feeds are reversible and feed changes of 1/32 in., 1/16 in. and 1/8 in. are obtained through a feed box located on the headstock. Hand movement is also provided for both longitudinal and cross feed. The cross feed is provided with a micrometer dial so as to expedite the setting of the cutting tool. The feed screws are provided with ball-thrust bearings and felt wipers protect the slides from dirt and chips. The tool holders are of the single-screw clamping type to allow angular setting. The tools are held in place by two large set screws. A holder is also provided with a thousandths reading gage, to be clamped in the tool post for feeding across the journal to determine its lowest point of wear.

The headstock is mounted on the bed and traversed laterally through an independent 5-hp. motor. Both the bed ways and the headstock seats are fitted with renewable steel wear-plates; those on the bed ways being hardened. Felt wipers are provided to protect the ways from dirt and chips. The headstock is clamped in position by two T-head bolts drawn tight through a unit eccentric clamp. The upper faces of the clamping T-head slots are protected with renewable steel wear-plates.

The headstock spindle is of the non-rotating type and the work revolves on a live center built directly into the spindle. The spindle in-and-out movement is accomplished through a hand wheel conveniently located. The 15-hp. drive motor is mounted on the back of the headstock and is connected to the gear box through a flexible drive. The gears are enclosed and run in oil.

The face plate revolves on a large bronze bearing and is driven by V-belts from the gear-box shaft. The belts have a circumference drive contact on the rim of face plate of 270 deg. This belt drive has been adopted because it is considered to be the most desirable for obtaining a smooth finished journal.

The face plate carries an adjustable built-in counterweight which counterbalances the different classes of wheel sets from the zero to the heaviest main drivers. The counterweight is guided in tee slots for position, and is moved through gears and screw by a crank wrench placed on a square on the front face of the face plate. Locking bolts clasp the counterweight in its adjusted position. A hand brake with large shoe contact area on the rim of the face plate provides an immediate stop for position. Two ovals are provided in the face plate for receiving the crank pin of either right or left-hand lead engines. This allows wheel sets of either type to be chucked changing any mechanism on the machine other than to set the counterbalance in its proper position with respect to the type of wheel set chucked. A driver dog is furnished for driving the wheel set. An ammeter is located on the front of the headstock which enables the operator to detect when wheels are not properly counterbalanced.

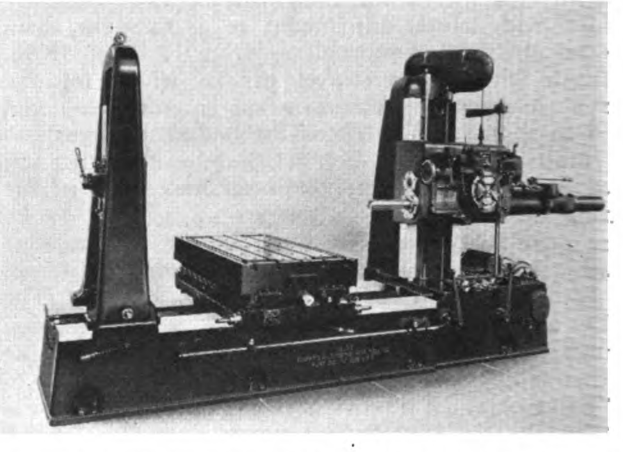
The tailstock is mounted on the bed and traverses laterally through an independent 5-hp. motor. Both the bed-ways and tailstock seats are fitted with renewable steel wear-plates; those on the bed-ways are hardened. Felt wipers are provided at the bed-way areas to protect the ways from dirt and chips. The tailstock is clamped in position by two tee-head bolts drawn tight through a unit eccentric clamp. The spindle is moveable in and out by a hand wheel and is clamped in any fixed position by a positive type of clamp which does not affect its alinement. A live-dead center mounted on anti-friction bearings is built directly into the spindle.

The bed of the unit is of heavy construction and is so arranged to catch and drain the fluid compound to a central reservoir. The fluid compound is circulated to all grinding units by a rotary pump driven by an independent 1-hp. motor. Suitable guards are provided over belts around the grinding heads, over the wear areas and feeding mechanism where possible, for confining the spray of the fluid compound.

Three of the machines have been installed on the Canadian National at the Point St. Charles, Montreal shops; at the Stratford, Ontario shops; and the Transcona, Winnipeg shops. Tests on these machines show floor to floor time of 43 min., 32 min. and 33 min. for refinishing the journals of standards size driving wheels. The speed of the machine in all instances for turning and grinding was 30 r.p.m. and 15 r.p.m respectively at 1/16 in. feed.

Giddings & Lewis No. 30 Boring Drilling and Milling Machine

Two spindles, the conventional main spindle and an auxiliary high-speed spindle, comprise one of the important features of another machine recently added to the line built by the Giddings & Lewis Machine Tool Company, Fond du Lac, Wis. This machine is known as the No. 30 horizontal boring, drilling and milling machine. The main spindle, 3 in. in diameter, gives 36 speeds in fine geometrical progression between 8.3 and 500 r.p.m. The auxiliary high-speed spindle, 2 in. in diameter and mounted within the back gear shaft of the main spindle, gives an additional 36 speeds between 25 and 1,500 r.p.m. These two spindles give a combined speed range of from 8.3 to 1,500 r.p.m. It is fitted with herringbone gears and preloaded combination radial and thrust ball bearings. The No. 30 machine is similar in detail and operation to the No. 70 machine of the same type and which was described in detail on page 326 of the June, 1931, issue of the *Railway Mechanical Engineer.*



Giddings & Lewis No. 30 two-spindle horizontal boring drilling and milling machine

The bed of the machine is of heavy box-type construction, internally ribbed to support the various units of the machine. A large cutting lubricant tank is cast within the bed, and when required provision is made on the different units for directing the solution back to this tank.

The table is of semi-steel and of ribbed box section.

(Continued on next left-hand page)

WHAT

makes an ideal

BOILER TUBE?

Of course it must be seamless. And boiler tubes of Toncan Iron *are* seamless, in fact, the *only* seamless iron boiler tubes.

Then, the ideal boiler tube should work readily. Not only do tubes of Toncan Iron work easily but cold working does not affect their resistance to corrosion and to fire-cracking.

Finally, boiler tubes must give long service once they are in place. Here Toncan Iron excels. This alloy of refined iron, copper and molybdenum has greater corrosion resistance than any locomotive boiler tube material.

Seamless Toncan Iron boiler tubes have proven their desirability by years of service under many different conditions.

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REPUBLIC STEEL CORPORATION

HEADQUARTERS: YOUNGSTOWN, OHIO

The top of the table has 1-in. stop holes and five standard tee slots for ¾-in. diameter bolts. Chip pockets are cast in the table at each end and the tee slots run the full length of the table. The bottom of the tee slots is drilled so that chips can fall through to the center cored hole.

The table is supported on a saddle which supports the table at every position of its cross travel. A multiplying lever clamp is used for clamping the table to the saddle and also the saddle to the bed.

Within the front head end of the bed is built a separate feed unit for moving the different units. The milling feeds are obtained from a separate drive shaft ahead of the start, stop and reverse clutches. In this way the reversal of the machine does not reverse the feed or rapid traverse. The rapid traverse is always in the same direction as the feed. The levers for engaging the feed to any unit are engaged by moving the lever in the direction the unit is to move, either by feed or rapid traverse. This feature removes all uncertainty as to which direction the units will move as soon as the feed or rapid traverse is applied and permits a directional control of the different units of the machine, independent of every other unit.

The hand feed for moving the different units is through a safety crank handle. To feed by hand, the crank handle must be held in a jaw clutch against the spring. As soon as the hand is removed the crank is disengaged and swings free. This safety feature prevents injury to the operator and possible damage to the machine if the rapid traverse should be engaged without first removing the crank handle. The mechanism for the movement of the different units is equipped with micrometer dials, which are adjustable by a thumb screw permitting them to be set in any position desired by the operator.

This No. 30 machine, like the No. 70 two-spindle machine can be furnished in the table type, planer type and floor type, using the same principal units in all three types.

Additional principal specifications of this machine are as follows: Range of feeds to main spindle in inches per revolution of spindle—.007 in. to .375 in.; range of feeds to auxiliary spindle in inches per revolution of spindle—.002 in. to .125 in.; range of milling feeds in inches per minute—.8 in. to 40 in.; rapid traverse to all units—120 in. per minute.

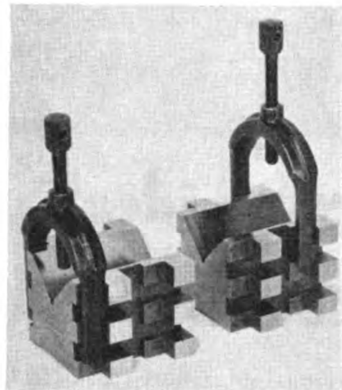
B. & S. Metal-Slitting Saws And V-Blocks

The Brown & Sharpe Manufacturing Company, Providence, R. I., has recently added to its line of cutters 21 sizes of metal-slitting saws with side-chip clearance. These saws, which are made of high-speed steel, have been developed to increase production and lessen cutter breakage, because the design permits the chips to be carried out of a deep slot without jamming the saw in the work.

Large chip space is provided; in addition to the pockets at the sides of the teeth, the sides of the saws are recessed. There is also concavity on the lateral cutting edges. The extra clearances reduce rubbing and dragging with attendant heating and jamming tendencies.

The saws are made in diameters from 3 in. to 8 in. in a suitable range of thicknesses. The teeth of saws up to and including 5/32-in. thickness are made in conventional straight tooth type; saws of 3/16-in. thickness are made in staggered tooth type.

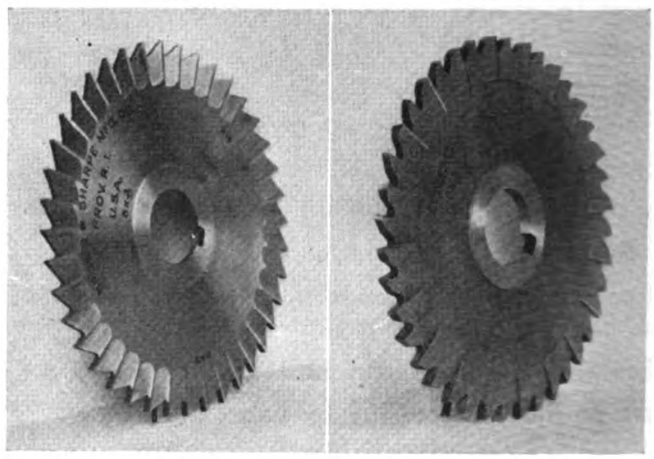
This company has also recently announced two tools known as V-blocks and clamps No. 750B and V-block No. 750C. V-blocks and clamps No. 750B has stepped clamping lugs and the blocks can be used on their sides as the clamps do not project. The stepped construction



Left: The Brown & Sharpe No. 750B V-blocks and clamps —Right: The No. 750C V-block

also allows changing the clamps quickly from small work to work up to 2 in. diameter. The blocks are ground in pairs and all sides are at right angles; they can be used in any position. Also the V grooves of any pair of blocks are ground central and in alinement. Each blocks is of hardened steel 2½ in. long, 2¾ in. wide and 2 in. high and are made and sold only in numbered pairs. The clamps are drop forged and the clamp screws are hardened.

V-Block No. 750C is designed to hold stock of square or rectangular cross section, as well as round



Left: The B. & S. straight-tooth metal-slitting saw designed with side-chip clearance—Right: The staggered-tooth type of saw which is made in thickness of 3/16 in. and over

stock, leaving the entire top side of the work accessible. A hole through the center of the block allows drills, drifts, etc., to project through the work. A tongue in the bottom is a convenience when the block is used on a machine table where it can be clamped by the flanges in the customary manner. The 750C-block is of hardened steel 3 in. long, 4¾ in. wide, 2 in. high and is ground on its bottom side. It has a capacity for round stock up to 1½ in. diameter.

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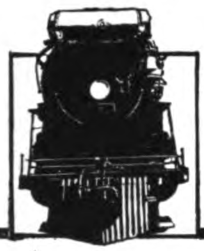
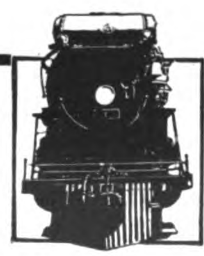
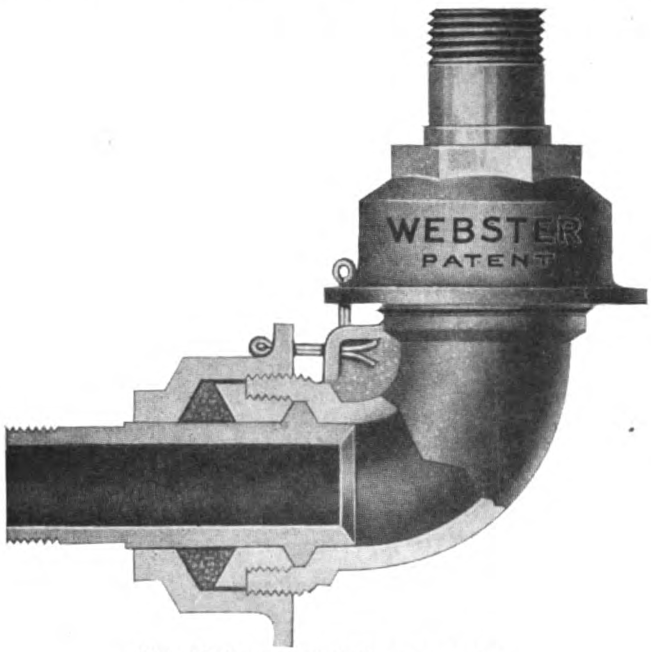




The Webster Rotatable Pipe Joint

THE National Bearing Metals Corporation, St. Louis, Mo., has recently placed on the market the Webster rotatable pipe joint. The joint is made of bronze and carbon-steel tubing and is so designed that the contact point at the seat will always remain in the same relative position. The joint does not depend on the packing gland for its efficiency. It holds the male member in a parallel position, absorbs vibration and makes a long bearing, to prevent cramping.

It is made in the straight-joint and the double-joint types, the former being designed to rotate in one plane



The Webster rotatable pipe joint

only while the latter is rotatable in two planes at right angles to each other. Both types are made in various sizes from ¼ in. to 6 in. in diameter, all threads being of standard pipe size. Larger sizes of joints can be furnished if desired.

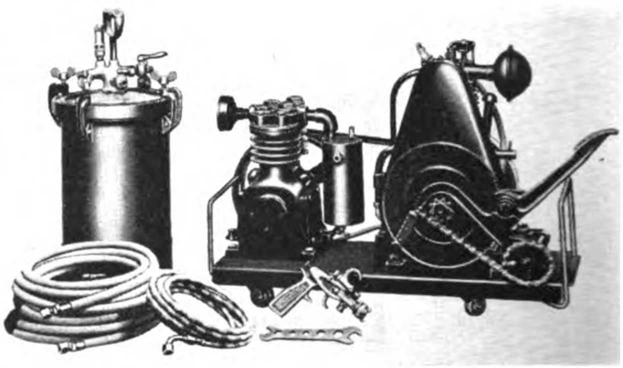
The Webster rotatable pipe joint is designed for applications where flexibility is required, replacing hose connections on passenger cars, locomotives, enginehouse blower connections, on steam shovels, trip hammers, etc.

Smith Tool for Parting Pistons—A Correction

IN the description of the Smith Strong-Back piston parter, produced by the Clark Manufacturing Company, 110 Turner street, Philadelphia, which appeared on page 333 of the June, 1931, issue of the *Railway Mechanical Engineer,* it was stated that the rear yoke is fitted with a hydraulic cylinder and piston operated by a ratchet wrench, the piston of which is set against the end of the locomotive piston rod. This is incorrect; the Smith tools develop their power by mechanical means instead of by hydraulic pressure. The Strong-Back parter uses the same wedge-and-roller principle which is applied to the Smith piston parter, but applies the pressure on the outside of the crosshead member.

DeVilbiss NH606 Paint-Spraying Outfit

A LIGHT-duty spray-painting outfit driven by a gas-engine has recently been developed by The DeVilbiss Company, Toledo, Ohio. This equipment, known as the NH606, makes possible spraying-painting of light or small work at points where electric current



The DeVilbiss NH606 paint-spraying outfit

is not easily available and can be carried by one person or in any standard make automobile

The outfit consists of one DeVilbiss spray gun with adjustable spray head and wrench; one 20-ft. length 5/16-in. air hose and connections; one 12-ft. length ¼-in. braid-covered hose and connections; one 12-ft. length 5/16-in. DeVilbiss fluid hose and connections; one QN 2-gal. paint tank and one NH ½-hp. gas-engine driven compressing equipment, mounted on a hand truck.

The Mercury Type D Gas Tractor

IN the illustration is shown the Mercury Type-D gas tractor designed and built by the Mercury Manufacturing Company, 4118 South Halstead street, Chicago. The tractor is for use as a pulling unit to handle trailing loads. It is equipped with a Ford Model-A industrial engine with a Model-AA truck clutch and 4-speed transmission. The driving axle is of the Mercury balanced internal-gear type which is of full floating design. All

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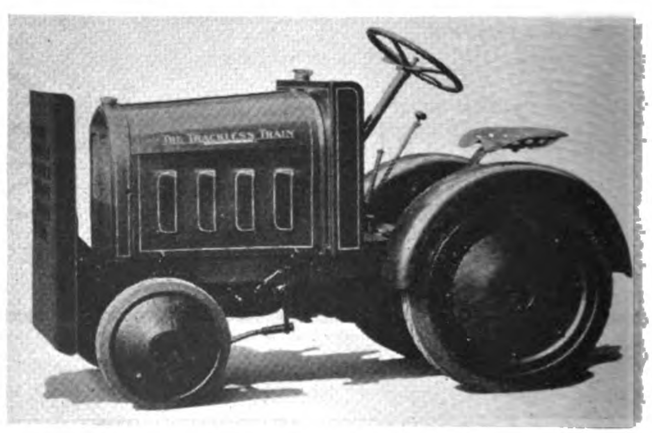


The Mercury Type-D tractor for hauling trailing loads

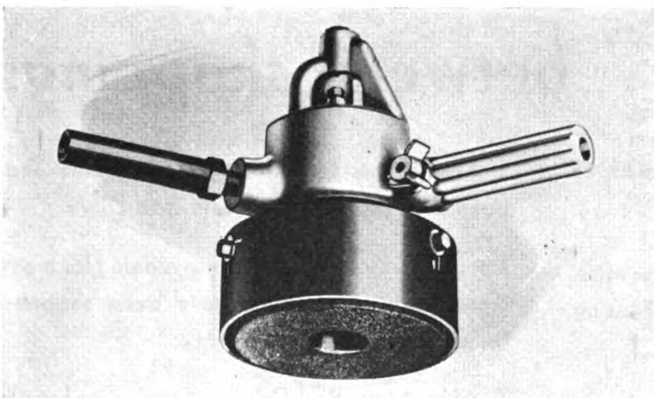
shafts, gears and pinions are of alloy steel; the rear-axle shafts being chrome-nickel steel.

The frame of the tractor is made from channels which are bolted at the front to a steel bumper plate and riveted to a cast weight block at the rear. The power plant is mounted within the frame with a three point suspension for the engine. The driving axle is bolted to the frame; no spring suspension is used, this design being adapted to secure minimum overall length, large diameter driving wheels with low center of gravity and simplicity in connecting the power plant to the axle. The front axle is a steel casting that supports the frame on semi-elliptic springs.

The tractor is designed to travel at a speed of 13.5 m.p.h. at an engine speed of 1,750 r.p.m and to deliver a suspension drawbar pull of 750 lb. at 10 m.p.h. Under unusual operating conditions a low gear is made available in order to produce 2,500 lb. drawbar pull. The tractor is 85 in. long, 59 in. high and 45 in. wide with single tires and 57 in. wide with dual tires. The short wheel base of the tractor permits it to negotiate 75 in. intersecting aisles, the minimum inside radius of which is 43 in. and the minimum outside radius 104 in.

Ingersoll-Rand Multi-Vane Surface Grinder and Sander

A GRINDER and sander of the Multi-Vane type FP-2, designated as the 4F size, has been added to the line of Ingersoll-Rand Company, 11 Broadway, N. Y. This tool is designed for grinding, sanding, polishing, and wire brushing operations and can be fitted with a grinding wheel, sanding head, or wire brush for sanding and polishing passenger-car bodies,



The Ingersoll-Rand size 4F Multi-Vane grinder and sander

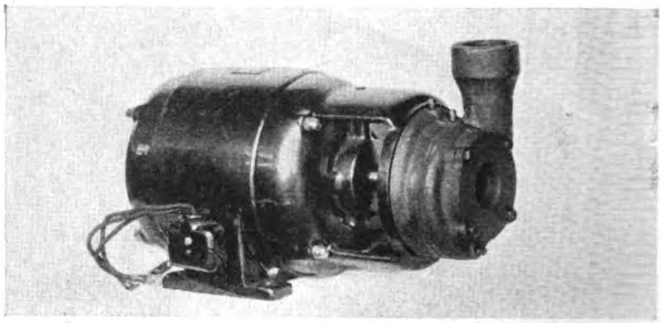
smoothing down welds, cleaning and surfacing large castings for painting, polishing locomotive side rods, sanding metal furniture, dies and other metal and wood surfaces, and wire brushing.

The machine is built with two handles so that the operator can hold it at right angles to the working surface. One of the handles may be removed to facilitate working in close quarters. The second handle acts as the air inlet and contains a thumb-controlled throttle valve.

The standard free speed of the tool is 4,600 r.p.m., but units can be furnished for higher or lower speeds. Overspeed is prevented by a governor. The size 4F grinder and sander weighs 10¾ lb.

Worthington Type-D Centrifugal Pump

THE centrifugal pumping unit shown in the illustration is a product of the Worthington Pump & Machinery Corporation, Harrison, N. J. It is designed with the pump bolted to the extended motor frame, the impeller being mounted on the end of the continuous motor shaft. The pumping unit has been designated as the Type-D Monobloc centrifugal pump. The im-



The Worthington type-D Monobloc pumping unit

peller is of bronze and incorporates the shaft sleeve as an integral part, this design being adopted as a shaft-protection feature. The impeller is also fitted with a cadmium-plated steel locking device.

The unit is equipped with a ball-bearing Masterbilt motor, incorporating standard electrical construction. Motors ranging from ½-hp. to 5-hp. capacity can be used with the unit, depending upon the capacity desired. These motors, running at speeds ranging from 1,725 r.p.m. to 3,425 r.p.m., can be furnished for 115-Volt direct current or for alternating current of 110, 220, 440, or 550-volts. The capacity range of the pumping unit is 10 to 140 gal. per min. All ratings are based on a maximum suction lift of 15 ft. The pump can be used as a built-in part of assembled equipments for air-conditioning apparatus, ice, water and brine circulation, etc.

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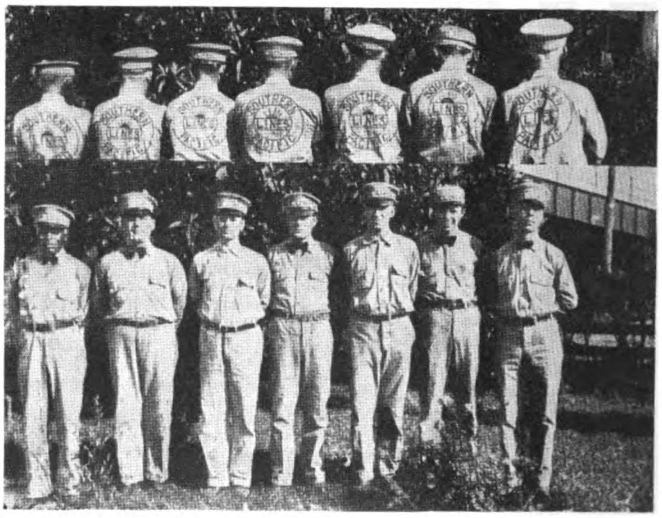


Car men adopt uniforms

The car inspectors and car oilers employed on the Houston division of the Southern Pacific at San Antonio have adopted and purchased uniforms and now wear them both for the purpose of indicating their occupation and advertising the company. We show here the inspector and oiler crew and their new garb.

Among the Clubs and Associations

WESTERN RAILWAY CLUB.—J. H. Nash, western manager of the Dri-Steam Valve Sales Corporation at Chicago, has been elected secretary of the Western Railway Club.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—George W. Rink, mechanical engineer of the Central Railroad of New Jersey, has been elected chairman of the Plainfield (N. J.) Section of the American Society of Mechanical Engineers. Mr. Rink was vice-chairman of this Section and also has been active in the work of the Railroad Division of the society.

NEW YORK RAILROAD CLUB.—The summer outing of the New York Railroad Club on June 30 was attended this year by 575 members of the club and their guests. This outing combined both the golf tournament and the field sports, all in one place for the first time, at the grounds of the Westchester Country Club, Rye, N. Y. The chief enthusiasm was as usual centered in the golf games and tournaments, the players having started early in the day, and continued until its close. The regular annual golf tournament, which was open to members and guests, provided for the awarding of a number of beautiful and useful prizes. Prizes were also presented to winners of other events. ¶The second annual open team championship for railroad and railroad supply companies was won by the American Brake Shoe & Foundry Company. The exhibition match was closely followed by a large gallery. The contestants in this foursome were Jess Sweetser and Gene Tunney versus R. T. Jones, Jr. and George Voight. The match was won by Jones and Voight—4 up and 2 to play. The other golfing events included driving and putting contests for those who played in the golf tournament; also similar contests for non-golfers. In the evening, the Westchester Country Club provided a dinner at 7:30 during which time, following the address of George LeBoutillier, president of the New York Railroad Club, prizes were awarded to the successful contestants in the various events. The committees this year were in charge of J. S. Doyle, general chairman; Maurice N. Trainer, golf chairman; and Thomas P. O'Brian, field chairman. The attendance included, in addition to a number of railroad executives, many railroad men and those from allied manufacturing industries.

Club Papers

Interchange Rules Discussed

Railway Carmen's Club of Peoria and Pekin.—Two meetings were held on May 15 at the Union Station, Peoria, Ill. The morning meeting was held at 10 a.n for the members who work at night and the regular meeting was held at 6:30 p.m. Both meetings were addressed by W. J. Owen, chief interchange inspector at Peoria, Ill., who discussed and explained Interchange Rules 4, 32 and 44. Mr. Owen, aside from discussing the above interchange rules, emphasized the necessity of co-operation at all times between all members of the car department and stressed particularly the necessity of car inspectors doing their utmost in speeding cars in interchange by prompt handling to the repair track so that repairs can be completed in time to forward the car in the train for which it is scheduled.

Lackawanna Electrification

New York Railway Club.—Meeting held on May 15 at the Engineering Society's Building, 29 West 39 Street, New York. The meeting, designated as "Lackawanna Night," was attended by more than 800 members and guests. ¶Entertainment of the evening was provided by D. L. & W. Glee Club of 23 male voices, the members of which are recruited from among the employees of the Buffalo Division. The first paper of the evening was presented by G. J. Ray, chief engineer of the Lackawanna who discussed the D. L. & W. suburban electrification in New Jersey. ¶A paper "High Spots of Electrification on the Lackawanna" was next presented by E. L. Moreland, of Jackson & Moreland, consulting engineers of Boston, Mass. Mr. Moreland discussed the reasons why the 3,000-volt current system was adopted for the Lackawanna conditions, the selection of equipment, the supplying of direct current power from the sub-stations through rectifiers and operating speeds. ¶Following this address, J. S. Thorp, electrical engineer of the Lackawanna, gave an "Informative and Interesting Description of Sub-Stations and Construction of Catenary System." This part of the evening's program was illustrated with slides showing the five sub-stations and the Catenary construction of the electrification. ¶J. J. Pierce, assistant superintendent of the Lackawanna, addressed the meeting on "My Experience with Commuters." ¶The next paper of the evening "Multiple-Unit Cars, Three-Power Locomotives and Training of Employees for D. L. & W. Electrification" was presented by E. E. Root, division master mechanic of the Lackawanna. ¶The last paper of the evening entitled "Signals and Interlocking" was presented by J. E. Saunders, signal engineer of the Lackawanna.

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

ALLIED RAILWAY SUPPLY ASSOCIATION.—F. W. Venton, Crane Company, Chicago.

AMERICAN RAILWAY ASSOCIATION.—DIVISION V. —MECHANICAL.—V. R. Hawthorne, 59 East Van Buren street, Chicago.

DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey street, New York.

DIVISION I. — SAFETY SECTION. — J. C. Caviston, 30 Vesey street, New York.

DIVISION VIII.—CAR SERVICE DIVISION — C. A. Buch, Seventeenth and H streets, Washington, D. C.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS — Carlin W. Rice, 29 W. Thirty-ninth street, New York.

RAILROAD DIVISION —Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York.

MACHINE SHOP PRACTICE DIVISION. — Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.

MATERIALS HANDLING DIVISION.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.

OIL AND GAS POWER DIVISION.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.

FUELS DIVISION.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa.

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS —Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

CAR DEPARTMENT OFFICERS ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

INTERNATIONAL RAILROAD MASTER BLACKSMITH'S ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago. Business session, without exhibit or entertainment, September 15 and 16, Hotel Sherman, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash street, Winona, Minn.

MASTER BOILERMAKER'S ASSOCIATION. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

MASTER CAR BUILDERS' AND SUPERVISORS' ASSOCIATION.—See Car Department Officers Association.

NATIONAL SAFETY COUNCIL—STEAM RAILROAD SECTION.—W. A. Booth, Canadian National Montreal, Que. William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

RAILWAY BUSINESS ASSOCIATION — Frank W. Noxon, 1124 Woodward building, Washington, D. C.

RAILWAY FIRE PROTECTION ASSOCIATION.—R. R Hackett, Baltimore & Ohio, Baltimore, Md.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION. —J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

SUPPLY MEN'S ASSOCIATION. — E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division American Railway Association.

TRAVELING ENGINEERS' ASSOCIATION. — W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio.

NEWS

THE ATCHISON, TOPEKA & SANTA FE has let a contract to the Roberts & Schaefer Company, Chicago, for the construction of a 200-ton capacity reinforced concrete automatic electric locomotive coaling plant, a gravity sand plant with steam drying facilities, and an electric cinder handling plant at Boise City, Okla.

Salary Reduction for Officers of Pennsylvania

DIRECTORS OF THE PENNSYLVANIA at a meeting on June 24 approved a reduction of 10 per cent in the salaries of all executives and general officers of the company. At the same meeting action was taken reducing the annual dividend rate from 8 per cent to 6 per cent on the common stock of $50 par value.

Stevens Honors Wright

STEVENS INSTITUTE OF TECHNOLOGY at its commencement exercises on June 6 conferred the honorary degree of Doctor of Engineering upon Roy V. Wright, editor of the *Railway Mechanical Engineer* and president of the American Society of Mechanical Engineers. The citation of Mr. Wright's accomplishments reads as follows:

"ROYDON VINCENT WRIGHT.—Mechanical Engineer, whose practical experience in railway engineering has during twenty-seven years expressed itself through his work as an author, publisher and editor, whose sincerity and clarity of thought have given him a place of unusual significance among the interpreters of an age determined by mechanical achievement, who as President of the American Society of Mechanical Engineers now presides over the affairs of a great fraternity of engineers founded within our college walls."

Conference Board Finds "Real" Railway Wages Higher

DURING THE LAST QUARTER of 1930, both average hourly and average weekly real earnings of the railroad employees of the United States were higher than in any other recorded period during the last seventeen years, according to a tabulation of statistics made by the National Industrial Conference Board in its recently published report on "Wages in the United States, 1914-1930." The computations are based on data gathered by the Interstate Commerce Commission and relate to the employees of Class I railroads.

Average actual or money hourly earnings of all wage-earners employed on Class I railroads were slightly higher in 1930 than in 1929. The increase in average hourly earnings since 1923 amounts to 10.2 per cent. This increase does not necessarily denote a higher wage rate but may reflect merely an increase in the employment of more efficient workers or a decline in the employment of less efficient workers.

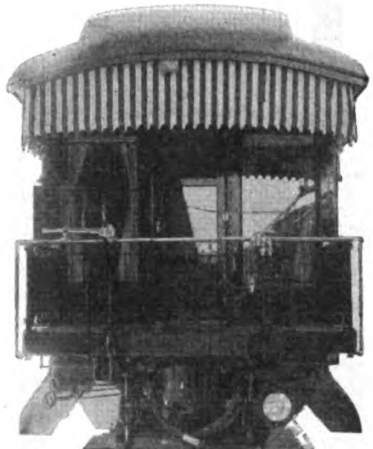
The favorable situation of the railroad wage-earners is shown by a comparison of their real earnings; that is, their actual money earnings expressed in terms of the cost of living, or the purchasing power of the dollar. Taking 1923 as a base, it is found that real weekly earnings in 1930 were 7.9 per cent above the 1923 level, as compared with 6.9 per cent in 1929.

Although the hourly earnings of all classes of railroad wage-earners were higher in 1930 than in 1929, the weekly earnings showed a slight falling off due to the fewer number of hours worked. The highest weekly earnings were those of road passenger engineers, which were $65.13 in 1930 as compared with $66.35 in 1929. Road freight engineers earned a weekly average of $60.51 in 1930 as compared with $64.11 in 1929. Road passenger conductors earned a weekly average of $60.44 in 1930 as compared with $60.96 in 1929. The lowest average weekly earnings were those of unskilled shop labor, which were $17.47 for 1930 as compared with $18.14 for 1929.

Draft Gear Case Argued Before Federal Trade Commission

ORAL ARGUMENTS were heard by the Federal Trade Commission at Washington, D. C., on June 11 in the case in which the commission had issued a complaint against the Waugh Equipment Company and individual officers of Armour & Company and the Armour Car Lines charging unfair methods of competition in the sale of draft gear to railway companies by promising or threatening the increase or diversion of Armour traffic. Argument in the similar case against the Mechanical Manufacturing Company and officers of Swift & Co., set for the following day, was deferred because of the absence of counsel for the Mechanical company in Europe.

The case against the Waugh company was argued for the commission by E. F. Haycraft, who asked the commission to issue a "cease and desist" order, while the argument for the defense was presented by E. M. O'Bryan. Mr. Haycraft said that stock in the Waugh company



had been given to the Armour officers, after the company had been unable to make much headway in the sale of its draft gear, but that with the assistance of the solicitation of the Armour traffic officers, through the traffic departments of the railways, its business had increased until in 1930 it was the largest seller in the country of draft gear for new cars.

Mr. O'Bryan, on the other hand, attributed the increase in the company's business to improvements in its draft gear and to the knowledge of the improvement which was disseminated among railway men as the result of the American Railway Association draft gear tests. The principal point he emphasized was that the large increase in the Waugh business did not begin until 1928, after an improved draft gear had been adopted, and said that the company had previously not been able to "break in" on certain roads until there was some change in the mechanical personnel; and he further argued that it was not proper to make comparisons of the business of various draft gear manufacturers on the basis of gears supplied for new cars, because so many more are used for maintenance.

Mr. Haycraft, in rebuttal, said that the report of the draft gear tests was not made until 1929, and that it was still only tentative; also that the detail testimony showed that Mr. Ellis had gone much farther in seeking to use traffic influence than merely to obtain a hearing for representatives of the Waugh company.

Air-Conditioned Diners on P.R.R.

DESIGNED to increase the comfort of passengers by reducing the heat and noise of summer travel, the Pennsylvania has recently placed in service its latest type dining car equipped with an entirely new air-conditioning system. The new type car, which circulates cooled and purified air regulated to any desired temperature, will operate on some of the Pennsylvania's de luxe passenger trains.

Preliminary tests have shown the possibility of maintaining a temperature of 76 deg. F., with an outside temperature of more than 100 deg. Under actual service conditions, the interior of the car can be kept at least 12 deg. below the outside temperature, when desired.

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Maximum insulation against cold as well as heat is embodied in the air conditioning system. The heating and cooling systems are entirely separate. Acoustic felt has been used to line the interior of the car, materially decreasing train noise and providing insulation.

The air-cooling system in dining cars of this new type consists of an ice chamber under the car, cooling radiators through which ice cold water from the chamber is circulated, and blowers for circulating the cooled air through the radiator coils into the car.

As the cool air is driven by fans into the car through vents located near the ceiling, the warm air is withdrawn through grilled openings skillfully fashioned into the wall design of the car. By a series of ingenious ducts, this air is reconditioned and mixed with fresh air brought in through intakes located on each side of the car. The fresh air is scientifically cleaned and controlled by strainers and dampers as it passes through the intake.

Because of the automatically controlled mixing and cooling of the car's air supply, the outer windows of the dining car are permanently sealed. Passageway doors prevent the entrance of heat through the outer doors and halls as diners enter or leave the car.

In keeping with the cooled condition of the car's atmosphere, decorations in gray tones, with blue trimmings, have been used in the interior design. Metal decorations are in silver, with walnut chairs and carpeting of blue and brown.

Fiftieth Anniversary Pittsburgh Testing Laboratory

The Pittsburgh Testing Laboratory, Pittsburgh, Pa., is this year celebrating its fiftieth anniversary, in commemoration of which it has published an interesting 32-page booklet illustrating its modern equipped laboratories and many of the problems of industry which have been subject to its inspection, research or test.

The laboratory was established in 1881 by Alfred E. Hunt and George H. Clapp, chemists and metallurgical engineers, under the name of Hunt and Clapp—Pittsburgh Testing Laboratory. This was in the early days of the steel industry and the firm became known as experts on steel, iron and other metallurgical problems, manufacturing processes and finished products incidental thereto. Aluminum was first produced on a commercial scale after research along the lines of the Hall patents by the Pittsburgh Testing Laboratory, both Mr. Hunt and Mr. Clapp being active in the organization of what has now become the Aluminum Company of America.

In addition to chemical and physical tests and investigations, the laboratory performs engineering inspection of all kinds and conducts research and special investigations into processes and industrial methods.

Avis Shops To Be Closed

The operation of the locomotive shops of the New York Central at Avis, Pa., is to be discontinued at the end of July and most of the machinery will be sent to the shops of the company at West Albany, N. Y. Arrangements will be made to enable employees to follow the work to West Albany so far as their seniority entitles them to positions.

Five Day Week for Southern Shops

Shop employees of the Southern have recently voted in favor of a plan proposed by the management for placing its shop operations on a five-day week basis, instead of operating for six days a week with fewer men. The vote was necessary because the employees had an agreement with the company on a six-day basis.

Pennsylvania Orders Mechanical Parts for 90 Electric Locomotives

The Pennsylvania has placed orders at a cost of $4,700,000 for the material and the construction of the mechanical parts or chassis of 90 of the 150 electric locomotives for which the railroad recently purchased the electrical equipment as reported in the June *Railway Mechanical Engineer.* The locomotive parts included in the new order consist of driving wheels, axles, trucks, frames and cabs and the structural parts in which the electrical apparatus will later be installed. The construction and material costs are in addition to the cost of electrical equipment recently ordered.

Of the locomotives included in the new order 54 will be built by the Westinghouse Electric & Manufacturing Company, at Eddystone, Pa.; 25 will be constructed by the General Electric Company, at Erie, and 11 will be built in the Pennsylvania's shops at Altoona.

Locomotive chassis to be built at the Westinghouse locomotive plant will use electric equipment manufactured by that company, and the locomotives to be built by the General Electric Company at Erie, and at the Altoona works of the Pennsylvania, will carry electrical equipment built by the General Electric Company.

Deliveries on this order are scheduled to begin not later than December of this year and the entire consignment of 90 locomotives is expected to be ready by June, 1932.

Optimistic on Tank Car Outlook

The next five years will see an increase in the number of tank cars in use in the United States over present levels and an increase in net earnings of the leading companies engaged in the operation of tank car equipment over the average net earnings of companies occupying similar leading positions in other industries, according to Ernest L. Nye, of Freeman & Company, a firm active in railroad equipment trust financing.

As a result of an extended trip in mid-continent territory, Mr. Nye expressed the firm conviction that the tank car industry has nothing to fear from the gasoline pipe line as a serious competitor.

"Figures reported by the leading lease line companies for 1930 show that during this year of depression these companies returned net earnings greatly in excess of the average net earnings of leading companies engaged in other lines of business," he said.

"The largest of the proposed gasoline pipe lines, for example, it is understood, will have a capacity equal only to 150 tank cars per day and this, as pointed out, will be more than offset by the additional distribution needed in short hauls. In fact, the total mileage of all the gasoline pipe lines now in operation, and all the proposed gasoline pipe lines, constitutes a total daily capacity of relatively small importance when the daily operation of the 185,000 tank cars of the country is taken into consideration.

Fuel Consumption Reduced

A new record in fuel conservation for locomotives was established by the railroads in 1930, according to reports for the year just compiled. An average of 121 lb. of fuel was required in 1930 to haul one thousand tons of freight and equipment, including locomotive and tender, a distance of one mile. This was the lowest average ever attained since the compilation of these reports was begun in 1918, being a reduction of 4 lb. under the best previous record established in 1929.

A new record in the consumption of fuel in passenger service was also established in 1930, an average of 14.7 lb. having been required to haul each passenger train car one mile, compared with 14.9 lb. in 1929.

The railroads in 1930 spent $275,213,781 for fuel for both road and yard switching service, compared with $325,813,895 in 1929. They used 97,857,093 tons of coal for both road and yard switching service. In 1929 the amount was 112,951,929 tons. The railroads also consumed in road and yard switching service in 1930 a total of 2,320,252,497 gallons of fuel oil compared with 2,568,800,341 gallons in 1929.

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Domestic Orders Reported During June, 1931

Locomotives

Name of Company	No. Ordered	Type	Builder
Albany (N. Y.) Port District Commission	2	Gas-Elec.	Mid-West Locomotive Company
Total for Month of June	2		

Freight Cars

Name of Company	No. Ordered	Type	Company
Cleveland Electric Illuminating Company	2	Hopper	Bethlehem Steel Co.
Chicago Great Western	500	Box	Pullman Car & Mfg. Corporation
General American Transportation System (Chicago)	250	Refrig.	General American Car Co.
Northwestern Refrigerator Line Co.	220	Refrig.	American Car & Foundry Company
Total for the Month of June	972		

Supply Trade Notes

F. H. Morehead, chief engineer of the Walworth Company, has been elected engineering vice-president.

The J. S. Coffin, Jr. Company has moved its office to its new building at 326 South Dean street, Englewood, N. J.

C. G. Bacon has resigned as director of wheel research of the Armco Railroad Sales Company, but remains with the company in a consulting capacity in connection with wrought steel wheels.

E. E. Griest, general superintendent of the Chicago Railway Equipment Company, has been appointed vice-president in charge of manufacture.

James A. Ireland, representative of Steel & Tubes, Inc., Cleveland, Ohio, has been appointed central district sales manager.

The Truscon Steel Company of Canada, Ltd., has opened an office at 620 Vancouver block, Vancouver, B. C. E. G. Ryley has been appointed manager.

Harry T. Gilbert, assistant to the president of the Republic Steel Corporation, Youngstown, Ohio, with headquarters at Cleveland, has resigned.

A. C. Moore, vice-president of the Chicago Railway Equipment Company, was elected executive vice-president at a meeting of the board of directors on June 13.

The Wood Conversion Company has opened a railroad sales office at 149 California street, San Francisco, Cal., in charge of O. J. Stevens.

The Monarch Machine Tool Company, Sidney, Ohio, has opened an office and showroom at 547 West Washington boulevard, Chicago, under the charge of Martin J. Luther.

W. J. Parker has been appointed commissioner of the Forging Manufacturers Association, succeeding G. H. Weiler. The new offices of the association are at 7 East Forty-Fourth street, New York.

Adolph Rider, Jr., representative of the Lukens Steel Company has been elected president of Lukens & Co., Inc., which has been organized to handle direct mill sales in New Orleans, La.

David Geissinger, formerly direct factory representative in Pittsburgh, Pa., for several machine tool manufacturers, is now affiliated with the Fort Pitt Steel Casting Company, McKeesport, Pa., as special representative.

R. H. Ripley, president of the General Steel Castings Corporation, Eddystone, Pa., has been elected chairman of the board to succeed Clarence H. Howard, resigned. Harrison Hoblitzelle, vice-president and general manager, at Granite City, Ill., has been elected executive vice-president, with headquarters at Philadelphia, Pa.

Lukenweld, Inc., division of Lukens Steel Company, Coatesville, Pa., has appointed W. R. McDonough & Company as representative in the Cleveland district, and the Dravo Doyle Company as representative in the Pittsburgh territory.

Lester A. Blackford, assistant treasurer of the American Car & Foundry Company, New York, was elected treasurer at a special meeting of the board of directors, to succeed Stanley Andrew Mallette, deceased.

Frank Baakes, Jr., a representative of the American Steel & Wire Company, with headquarters at Cincinnati, Ohio, has resigned to become a representative of the Keystone Steel & Wire Co., Peoria, Ill., with headquarters at Chicago.

C. G. Carter, vice-president and treasurer of the Liquid Carbonic Corporation, Chicago, has been placed in charge of sales, succeeding Carl J. Palmer, who has resigned to become vice-president of the Bastian-Blessing Company, Chicago.

The Puritan Compressed Gas Corporation, 2112 Grand avenue, Kansas City, Mo., has been appointed distributors in the state of Kansas and the western part of Missouri of the Weldite line of welding rods for the Fusion Welding Corporation, Chicago.

The Railway Equipment and Machinery Mart has been organized to make it possible for manufacturers to display their products in the St. Louis Mart building now being constructed on the southwest corner of Twelfth boulevard and Spruce street in St. Louis, Mo.

A. F. O'Connor, who has been with the Union Railway Equipment Company, Chicago, for the past 16 years, has resigned as vice-president and director of that company to become assistant to vice-president of the Equipment Specialties Company, Chicago.

Garrett A. Connors has been appointed vice-president and director of purchases of the Truscon Steel Company, with headquarters at Youngstown, Ohio. Mr. Connors has been for 24 years in the service as an executive in the production division of the same company.

The DeVilbiss Company, Toledo, Ohio, has changed the location of its St. Louis, Mo., sales and service branch from 1903 Washington avenue to 1937 Washington avenue, and has also changed its New York sales and service branch from 25 West Forty-third street to 25 West Forty-fifth street.

Joseph T. Ryerson & Son, Inc., Chicago, who, in 1924, purchased the interest of W. J. Reed and others in the Reed-Smith Company, Milwaukee, Wis., has now purchased the remaining stock, and the firm becomes the Reed-Smith Plant of Joseph T. Ryerson & Son of Wisconsin, Inc.

George F. Newell, representative of the Charles Engelhard Company, with headquarters at Chicago, has resigned to become vice-president and general manager of the Pyrometer Service & Supply Corporation, with headquarters at Cleveland, Ohio.

F. C. Pickard has retired as works manager of The Standard Stoker Company, Inc., and the following appointments have been made: H. P. Anderson, chief plant engineer; A. C. Secor, shop superintendent and N. J. Shea, chief plant clerk, all with offices at Erie, Pa.

Owen D. Kinsey, formerly general supervisor of shop machinery and tools of the Chicago, Milwaukee, St. Paul & Pacific, is now with the Whiting Corporation, Harvey, Ill., in charge of plant maintenance, including shop machinery, power-plant and tool-room equipment.

Charles G. Melvin, New York sales agent at 230 Park avenue, New York, of the Griffin Wheel Company, Chicago, has severed his connection with the company and the New York office of the company has been closed. Business will be handled from the Chicago office.

H. A. Paarman, secretary and treasurer of the Scientific Production Corporation, New York, has resigned to become vice-president in charge of sales, eastern district, of the Grip Nut Company, with headquarters in the Graybar building, 420 Lexington avenue, New York.

Sterling F. Ashley, until recently assistant chief draftsman of the New York Central, has been appointed sales engineer of T. H. Symington & Son, Inc., Baltimore, Md. Mr. Ashley was born on June

Sterling F. Ashley

2, 1897, at Chatham, N. Y. He attended the public schools of Chatham and in 1916 entered the service of the New York Central in its operating department. In 1917 he was transferred to the equipment engineering department as a draftsman and during successive years was promoted to the positions of leading draftsman, designing engineer and assistant chief draftsman. Mr. Ashley's experience has included the design and construction of new equipment and the maintenance of

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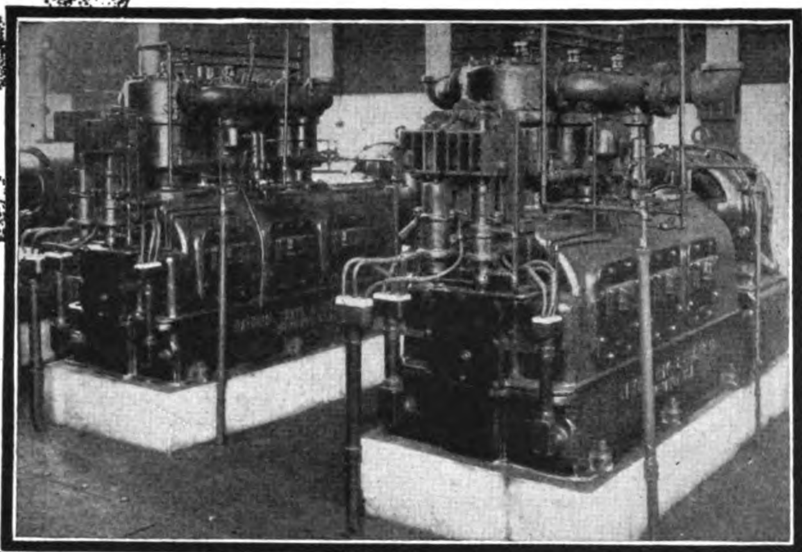

a "baker's dozen" in AIR COMPRESSOR VALUE

JUST as the old time baker threw in an extra bun for good measure, so the builders of Westinghouse-National Air Compressors add extra value to the machines they build .... They save valuable space for the user by designing compact machines that are driven direct by the motor or through efficient herring-bone gearing . . . they save installation cost by making complete self-contained machines that need no elaborate foundation nor require extensive auxiliary apparatus . . . they save operating expense by providing complete Automatic Control of distinctive type—which insures that the power consumed will be in proportion to the air compressed . . . they save maintenance expense by building durable machines that will operate for a score of years with minimum time and material for attention and upkeep—thus maintaining the noteworthy tradition of "Quality Machines for Quality Service" . . . Sizes range from 2½ to 700 cu. ft. displacement—for shops, yards, signals, car retarders, etc. . . . .

WESTINGHOUSE AIR BRAKE CO.

General Office and Works **Wilmerding, Pa.**

**WESTINGHOUSE–
NATIONAL
AIR COMPRESSORS**

existing equipment, and for the past five years he has also been engaged in research work pertaining to the operation of freight car trucks and truck springs in connection with road tests and investigations conducted by the New York Central test department.

The American Brown Boveri Electric Corporation has sold its electrical assets to the Allis-Chalmers Manufacturing Company and has cancelled its electrical connections in Switzerland. The American Brown Boveri Electric Corporation will continue its activities under the name of the New York Shipbuilding Corporation.

The Wilson Engineering Corporation has been organized, with headquarters at 122 South Michigan avenue, Chicago, to manufacture, engineer and market the mechanical equipment and devices heretofore handled by the Bird-Archer Company. The officers of the new company include: President, L. F. Wilson, formerly president of the Bird-Archer Company, and treasurer and mechanical engineer, V. E. McCoy, formerly assistant to the president of Bird-Archer.

The J. G. Brill Company, Philadelphia, Pa., has announced the closing on July 1 of its plant at St. Louis, Mo., formerly known as the American Car Company. In closing this plant the Brill management is following the trend toward the elimination of uneconomical operation by concentrating its manufacturing activities for electric railways in the west and middle west, at the plant of The J. G. Brill Company of Ohio, in Cleveland. The J. G. Brill Company's western region will continue sales representation in St. Louis, with R. S. Hood at 1558 So. Vandeventer avenue.

The American Locomotive Company and the Railway Steel-Spring Company have opened an office at Washington, D. C., in the Barr building, Seventeenth street, northwest, which will be in charge of Major W. G. Lockwood, general southern representative. These companies' offices in Richmond, Va., have been closed, and Ross Anderson, district sales manager, and B. C. Woody, sales agent will be transferred to Washington. The Washington office, in addition to handling the business of the aforementioned companies, will also look after the interests of McIntosh & Seymour and Alco Products, Inc., both of which are subsidiaries of the American Locomotive Company.

An Arrangement has recently been concluded by the United States Steel Corporation with Fried Krupp, A. G., Germany, whereby the subsidiary companies of the Steel Corporation are licensed by Krupp under various patents of Strauss, Johnson, Armstrong, Fry, Kuehn and Smith for rust-resisting and heat-resisting and other alloy steels, and for the heat treatment thereof. This arrangement, which includes the collaboration of Krupp with respect to technical matters in connection with corrosion-resisting and heat-resisting steels, etc., will apply to the products of the Illinois Steel Company, Carnegie Steel Company, American Steel & Wire Company, American Sheet & Tin Plate Company, National Tube Company, and Lorain Steel Company. The major products manufactured by these companies in corrosion-resisting and heat-resisting steels include shapes, plates and bars, strip, wire products, rope, sheets, tubes and castings.

Joseph A. Carlin, formerly receiver, has been appointed general manager, under a reorganization plan of the Hutto Engineering Company, Inc., Detroit, Mich.; Frank J. Jeschke has been appointed sales engineer; Ben O. Isom has returned to the company's service as factory representative for Detroit and Chicago territories; William F. Toepfer has been appointed factory representative for Philadelphia, New York and Boston territories; J. L. Navin has been appointed field engineer for Cleveland, Pittsburgh, Buffalo, Rochester and Syracuse territories and James G. Young is assuming responsibility for sales until June, when he will leave on a foreign tour prior to locating in Europe as the Hutto Engineering Company's oversea representative.

D. A. Lucas, who has been associated with the Prime Manufacturing Company, Milwaukee, Wis., and the late O. L. Prime for the past 13 years, has been elected vice-president of the company. Mr. Lucas

D. A. Lucas

has had a long experience in the railroad field. Prior to his association with the Prime Manufacturing Company he was for 47 years in railroad work, serving consecutively with the Milwaukee Northern; the Chicago, Milwaukee, St. Paul & Pacific, at Green Bay, Wis., and from 1892 for 25 years with the Chicago, Burlington & Quincy. Mr. Lucas has also taken an interest in civic affairs, having served as mayor of Havelock, Neb., while in the service of the Chicago, Burlington & Quincy.

Manning, Maxwell & Moore, Inc., New York, has discontinued the direct sale of Putnam machine tools in the Chicago territory. The Chicago sales branch of Manning, Maxwell & Moore was closed on May 1 and the Dean Machinery Company has been appointed to represent the company in the sale of Putnam machine tools in the machine tools. The new address of the Dean Machinery Company offices is 80 East Jackson boulevard, Chicago, with warehouse at 2601 Cottage Grove avenue. The Chicago office of the Consolidated Ashcroft Hancock Company, Inc., a subsidiary of Manning, Maxwell & Moore, Inc., will continue to operate without change. The manufacture of Shaw overhead electric traveling cranes will be continued at Muskegon, Mich., the direct sales of which in the Chicago territory will be handled at 80 East Jackson boulevard.

E. G. Grace, president of the Bethlehem Steel Corporation, has announced that an agreement has been made for the acquisition by Bethlehem of the properties and business of Kalman Steel Company, subject to the approval of the stockholders of the latter. Kalman Steel Company is a large fabricator and distributor of reinforcing steel, with warehouses in various cities in the Eastern and Middle Western districts.

Obituary

W. M. Rynerson, New York representative of the Carter Bloxonend Flooring Company, Kansas City, Mo., died on May 29.

Edward Scheffel, sales representative, eastern district, of the American Locomotive Company, died on May 3, at Brooklyn, N. Y.

William Lawrence Saunders, chairman of the board of directors of the Ingersoll-Rand Company, New York, died on June 25, at Teneriffe, Canary Islands.

Walter E. Coffin, mechanical engineer, National Malleable & Steel Castings Company, Cleveland, Ohio, died on June 25.

Joseph B. Terbell, chairman of the board of directors of the American Brake Shoe & Foundry Company and for the past 30 years connected with that company, died on April 15 at his home in New York City, at the age of 68.

Arthur Latham Church, mechanical engineer, secretary and assistant treasurer of the Baldwin Locomotive Works, Philadelphia, Pa., died of heart disease on June 25 at the Pennsylvania Hospital, Philadelphia, Pa. Mr. Church was born on October 11, 1858, at Philadelphia, and was graduated with the degree of B.S. from the University of Pennsylvania in 1878. His engineering career began in 1878 in the machine shop and drafting room of the William Cramp & Sons Ship and Engine Building Company, Philadelphia. He was later connected with the engine departments of the steamships Queen of the Pacific, City of Peking and Granada and as draftsman of the Union Iron Works, San Francisco, Cal. He went to the Baldwin Locomotive Works in 1886, and at the time of his death was secretary and assistant treasurer. Mr. Church was a member of a number of technical and other associations and was the author of a book on the Training of a Secretary.

(Continued on next left-hand page)

Personal Mention

General

THOMAS F. SHERIDAN, chief clerk to the superintendent of motive power of the Pittsburgh & Lake Erie, has been promoted to assistant to the superintendent of motive power, with headquarters as before at McKees Rocks, Pa.

R. R. MCKINNEY, motive power inspector in the office of the superintendent of motive power of the Eastern Pennsylvania division of the Pennsylvania, has been promoted to the position of gang foreman, first trick, at the East Altoona (Pa.) enginehouse.

THE JURISDICTION of W. H. Flynn, general superintendent of motive power and rolling stock on the New York Central, with headquarters at New York, has been extended to include the Harmon shop and forces engaged in maintaining electric and Diesel locomotives and multiple unit cars.

H. W. REINHARDT, who has been promoted to superintendent of motive power and equipment of the Chicago Great Western, with headquarters at Oelwein, Iowa, has been engaged in railway mechanical work for more than 23 years. He obtained his first mechanical training on the Chicago, Rock Island & Pacific at Horton, Kan. After completing his apprenticeship on July 5, 1908, Mr. Reinhardt served as a machinist on various railroads, including the Missouri Pacific. From August, 1912, to December, 1923, he was advanced successively on the Missouri Pacific through the positions of gang, enginehouse and general foreman at Falls City, Neb., division foreman at Omaha, Neb., gang foreman at Texarkana, Ark., general foreman at Paragould, Ark., and general enginehouse foreman at North Little Rock, Ark. He was then promoted to master mechanic at Crane, Mo., and was transferred to Poplar Bluff, Mo., in February, 1924; to Monroe, La., in January, 1926, and to Little Rock, Ark., in September, 1926. Mr. Reinhardt was appointed assistant superintendent of motive power and equipment of the Great Western at Oelwein in March, 1931, and his promotion to superintendent of motive power and equipment became effective on May 1.

H. W. Reinhardt

T. W. MCCARTHY, superintendent of motive power of the First district of the Chicago, Rock Island & Pacific, with headquarters at Des Moines, Iowa, has retired from active duty after 48 years of railway service. Mr. McCarthy was born at Dunkirk, N. Y., on April 27, 1862, and served his mechanical apprenticeship at the Brooks Locomotive Works and the Dunkirk Engineering Works. He entered railroad service in 1883 on the Union Pacific. Later he served with the Wheeling & Lake Erie and the Wabash, being appointed general foreman on the Rock Island at Shawnee, Okla., in 1906. On that road Mr. McCarthy served successively as master mechanic on the Arkansas, Panhandle—Indian Territory, Kansas and Cedar Rapids-Minnesota divisions. He had been superintendent of motive power of the First district at Des Moines since 1926.

Master Mechanics and Road Foremen

ALEXANDER MCPHEE has been appointed master mechanic of the Rocky Mountain division of the Northern Pacific with headquarters at Missoula, Mont.

D. S. LITTLEHALES, master mechanic of the Seattle division of the Northern Pacific, with headquarters at Seattle, Wash., has retired from active service, under the pension rules of the company.

W. H. SAGSTETTER, master mechanic of the Decatur division of the Wabash, has been promoted to assistant superintendent of the locomotive department, with headquarters as before at Decatur, Ill.

H. J. WADE has been appointed road foreman of engines of the Missouri Pacific—Kansas City Terminal and Central Kansas divisions, with headquarters at Kansas City, Mo.

T. D. SAAR, chief locomotive inspector of the Kansas City Southern, has been promoted to the position of division master mechanic, with headquarters at Pittsburg, Kan.

JOHN A. MARSHALL, master mechanic of the Rocky Mount division of the Northern Pacific at Missoula, Mont., has been transferred to the Seattle division with headquarters at Seattle, Wash., to succeed D. S. Littlehales, retired.

THE JURISDICTION OF C. S. BRANCH, master mechanic of the Northern and Southern divisions of the Chicago & Alton, with headquarters at Bloomington, Ill., has been extended to include the Western division.

H. W. BREWER, superintendent of shops on the Buffalo, Rochester & Pittsburgh at Du Bois, Pa., has been appointed general master mechanic in charge of motive power and equipment at Du Bois. The position of superintendent of motive power, which was formerly held by E. V. Williams, deceased, has been abolished.

R. V. CARLETON, division master mechanic of the Canadian Pacific at Ottawa, Ont., has been transferred in the same capacity to the Laurentian division, with headquarters at Montreal, Que.

H. J. MCCRACKEN, master mechanic of the Stockton division of the Southern Pacific at Tracy, Cal., has been appointed assistant master mechanic of the Salt Lake division, with headquarters at Sparks, Nev.

A. C. JOHNSON has been appointed master mechanic of the Pensacola division of the Louisville & Nashville, with headquarters at Pensacola, Fla., succeeding J. E. White, who retired from active service on June 1.

G. W. RAY, master mechanic of the Western division of the Chicago & Alton has been appointed assistant master mechanic of the same division with headquarters as before at Slater, Mo., and the position of master mechanic of that division has been abolished.

J. M. PIERCE, master mechanic of the Kansas City Southern at Pittsburg, Kan., has been appointed to fill the newly created position of general master mechanic at Pittsburg. Mr. Pierce will have jurisdiction over locomotive repairs on their entire line.

C. D. LOVE, assistant master mechanic on the Louisville & Nashville at Covington, Ky., has been promoted to master mechanic of the Nashville terminals of that railroad and the Nashville, Chattanooga & St. Louis, with headquarters at Nashville, Tenn., succeeding J. L. Enoch, who retired on June 15.

Purchasing and Stores

CHARLES S. WHITE, purchasing agent of the New York Central, has been promoted to the position of general purchasing agent of the New York Central Lines, a newly-created position, with headquarters at New York.

E. J. BECKER, traveling storekeeper of the Southern Pacific, with headquarters at San Francisco, Cal., has been promoted to district storekeeper, with headquarters at El Paso, Tex., succeeding L. G. Pearson, deceased. Mr. Becker will also act as division storekeeper of the Rio Grande division.

C. H. MURRIN, special stores accountant of the Illinois Central at Chicago, has been appointed general storekeeper of the Louisville & Nashville, with headquarters at Louisville, Ky., succeeding E. M. Atkins who held the title of acting general storekeeper and who has now assumed his former position as assistant general storekeeper at South Louisville. Mr. Murrin has been engaged in railway stores work for nearly 20 years. He entered railway service in 1904 in the mechanical department of the Chicago, Rock Island & Pacific at Silvis, Ill. A year later he

(Continued on next left-hand page)

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Four Test Locomotives For the Baltimore & Ohio

The Baldwin Locomotive Works builds two 4-8-2 types and two 2-6-6-2 types for test in passenger and freight service—One of each type is equipped with the Emerson water-tube firebox —The new articulated power was designed by the railroad for service over all parts of the main line of the system

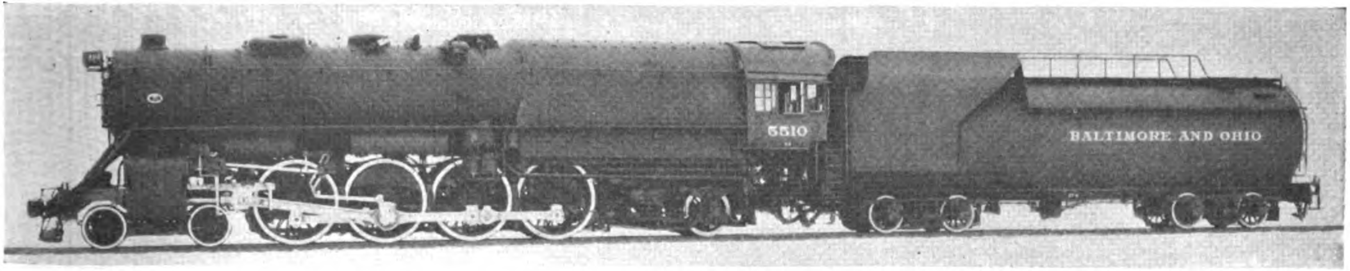
FOUR locomotives, two of the 4-8-2 type and two of the 2-6-6-2 type, were delivered to the Baltimore & Ohio in December, 1930, and January, 1931, for comparative tests in actual service over certain heavy-tonnage districts on the system. One each of the two types of locomotives are equipped with the Emerson water-tube firebox. The 4-8-2 type so equipped is known as the Class T-1, and the 2-6-6-2 type with the water-tube firebox has been assigned the classification KK-1. The 4-8-2 type built with the conventional stayed firebox is known as Class T-2, while the 2-6-6-2 type of conventional boiler construction is designated Class KK-2.

As shown in one of the tables, the two locomotives of the same type have essentially the same weights and dimensions. Locomotives Classes T-1 and T-2 develop a tractive force of 65,000 lb. They have 74-in. driving wheels and 27½-in. by 30-in. cylinders. The boilers operate at a pressure of 250 lb. Locomotives Classes KK-1 and KK-2 have a rated maximum tractive force of 90,000 lb. and operate at a boiler pressure of 250 lb. They have 70-in. driving wheels and four 23-in. by 30-in. cylinders.

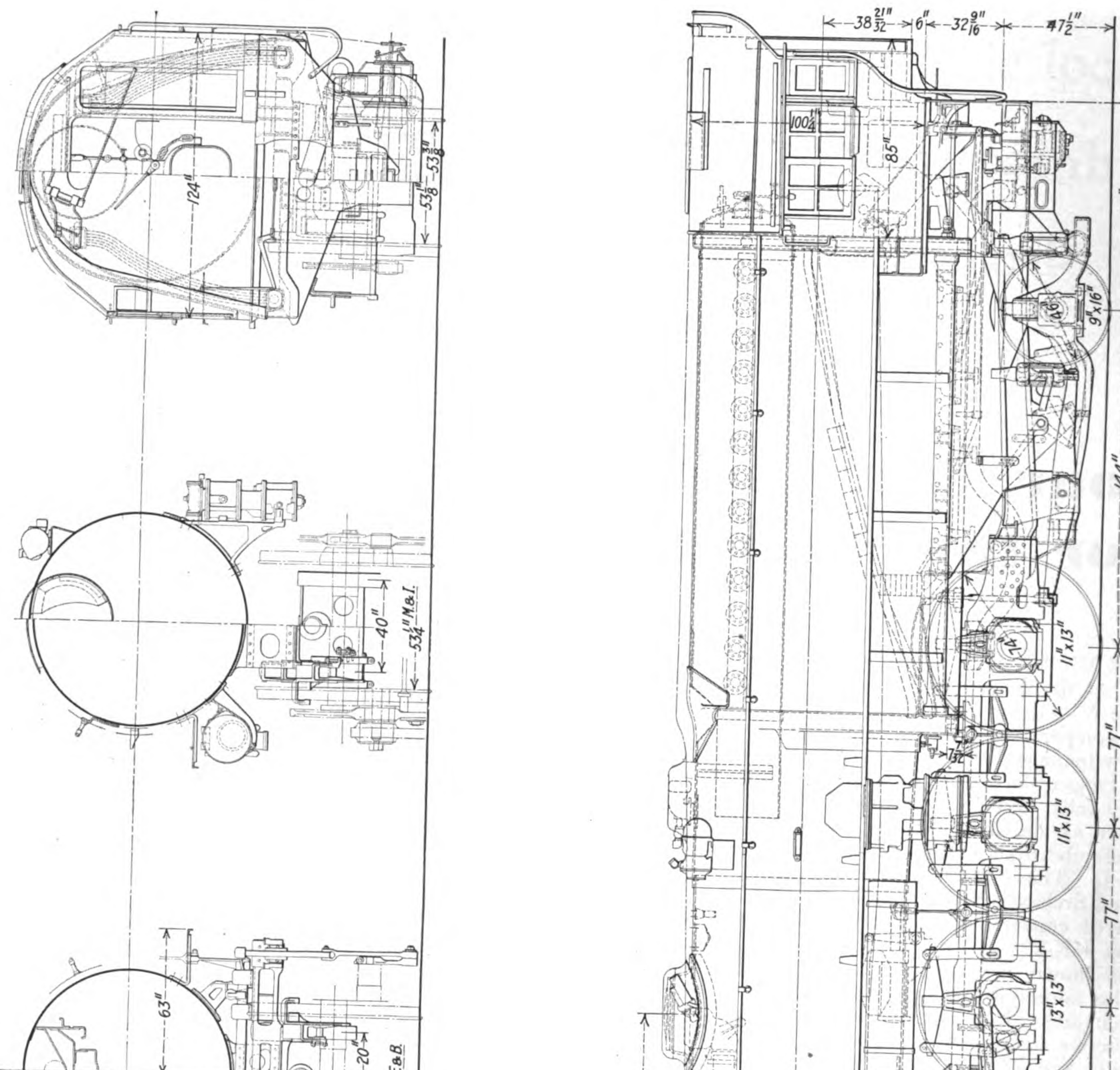
Several districts on the Baltimore & Ohio are served with either heavy 2-8-0 type locomotives or light 2-8-2 type locomotives on account of a number of bridge limitations, especially west of Grafton, W. Va. The 2-8-0 type locomotives have a tractive force of 50,900 lb. and the 2-8-2 types from 51,000 lb. to 56,000 lb. The Class Q-laa of the latter type generally used in that district, with 223,600 lb. on the drivers, are the heaviest locomotives permitted with the driving wheels spaced from 5-ft. 5-in. to 5-ft. 10-in. It is frequently necessary in order to move the tonnage in these districts to double-head the 2-8-0 and 2-8-2 type locomotives, with resultant high operating cost.

Considering the above points and also the fact that the cost to strengthen or rebuild all the structures to suit heavier and more powerful locomotives, such as the heavy 2-8-2 and 2-10-2 types, would be prohibitive and require a number of years, it was decided that it would be more economical to design new power. This resulted in the purchase of the KK-1 and KK-2 locomotives.

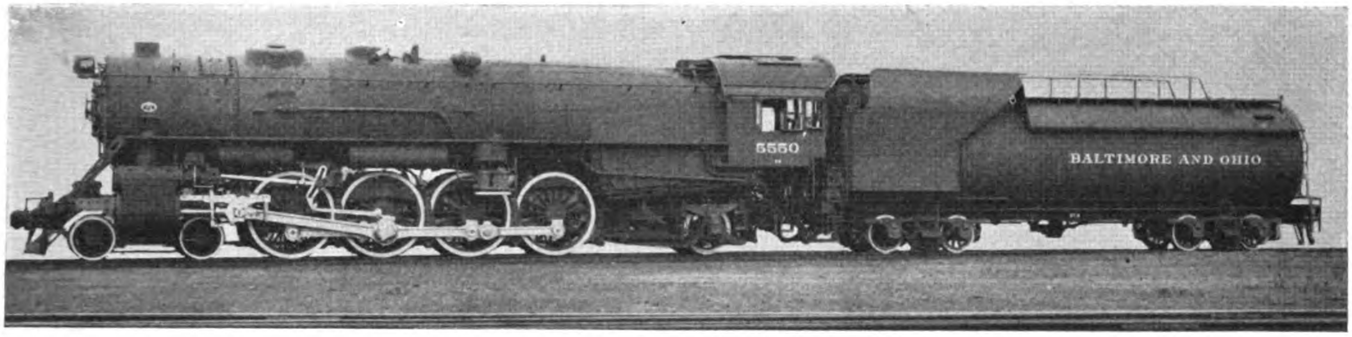
In the development of the design of the two articulated locomotives a careful study and comparison was



Class T-1 locomotive built for the Baltimore & Ohio by The Baldwin Locomotive Works—Equipped with the Emerson water-tube firebox

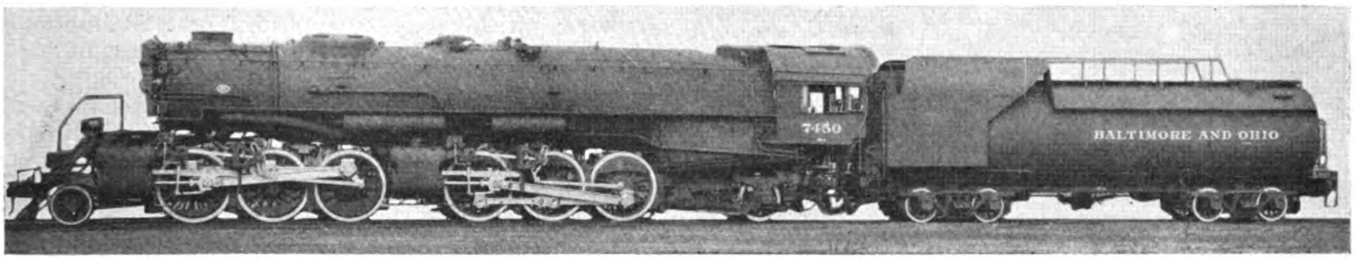


Elevation and cross-sections of the Baltimore & Ohio Class T-1 locomotive equipped with the Emerson water-tube firebox



Class T-2 locomotive built with the conventional stayed firebox

made of the design and performance of various types of locomotives already in service on the Baltimore & Ohio. The principal weights and dimensions of the types included in the study are shown in one of the tables. This study showed that a high-wheel light 2-6-6-2 single-expansion articulated locomotive with a tractive force of 90,000 lb. would meet the requirements. In addition, it was estimated that a locomotive of this design could be more economically used in the territories over main-line tracks where the heavy 2-8-2 and 2-10-2 types are used, because of the increased capacity and speed of the articulated power. The KK class locomotives can be operated anywhere on the Baltimore & Ohio lines between New York and Chicago, and East St. Louis, Ill. This includes the Reading and the New Jersey Central lines over which the Baltimore & Ohio operates to New York.



Class KK-2 single-expansion articulated locomotive

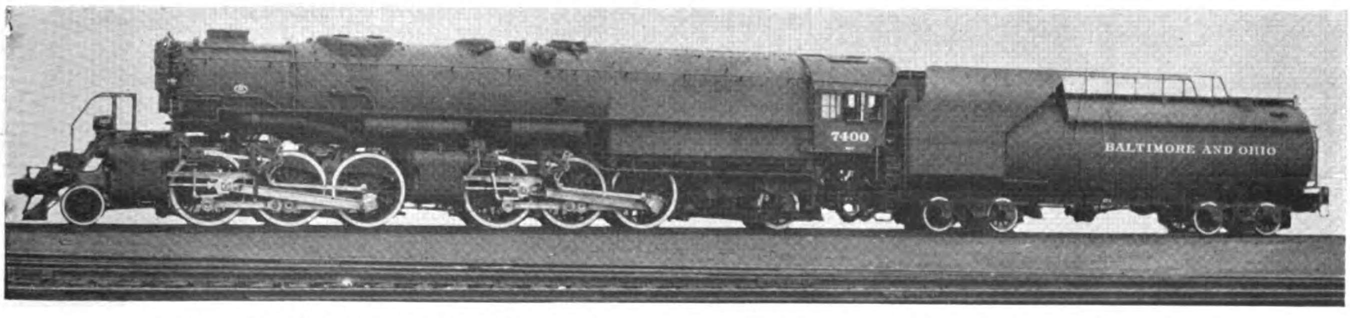
The 4-8-2 Types for Passenger and Fast-Freight Service

There is also some territory on the Baltimore & Ohio, especially between Washington, D. C., and New Castle Junction, Pa., that is now served with heavy stoker-fired 4-6-2 type passenger locomotives. However, with trains of over eight cars it is necessary to use helper service over mountain grades. To handle important passenger trains over the grades without a helper and also to meet weight and clearance limitations as well as operating schedules, the T-1 and T-2 class 4-8-2 type locomotives were designed. These locomotives have sufficient flexibility to meet the requirements described and to be used on the main line between New York and Chicago, and Grafton, W. Va. They are also suitable for handling fast-freight trains which are now handled by 2-8-2 type locomotives of the Q-4 class having 64-in. drivers.

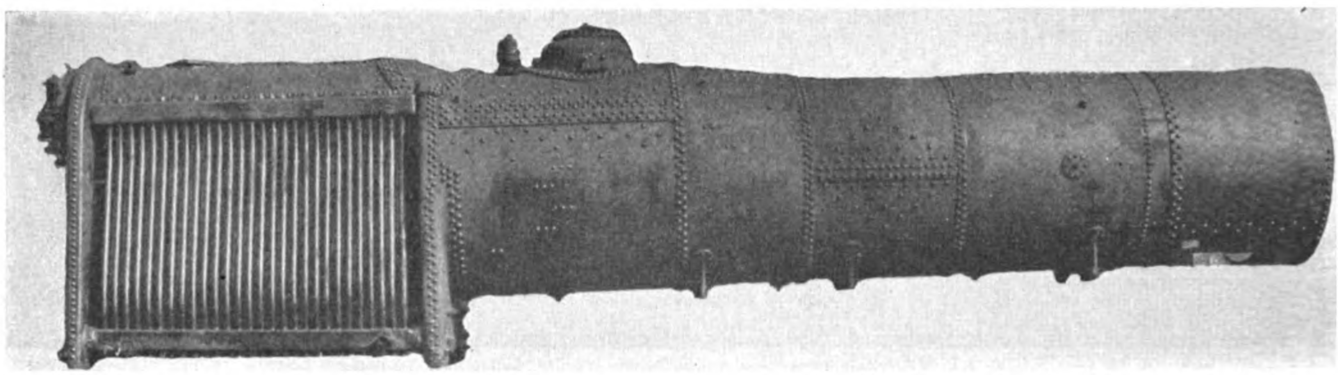
General Design and Construction of the Four Locomotives

The T-1 and T-2 class locomotives were designed to meet weight limitations of around 658,000 lb. With this limit, tenders with a capacity of 18,000 gal. of water and 20 tons of coal were found to be practicable. Comparisons of these two classes of locomotives with the Classes P-1d, Q-4 and T are also shown in the table on page 402.

The Classes T-1 and T-2 and also Classes KK-1 and KK-2 locomotives, respectively, are identical with the exception of the firebox and some of the boiler details. The two locomotives equipped with the Emerson water-tube fireboxes have Type A superheaters, while the two with the fireboxes of customary staybolt construction have two Thermic syphons and Type E superheaters. Other equipment applied to all four locomotives include Sellers exhaust-steam injectors, Lower stokers, power reverse gears, General Steel Castings Company cast-steel cylinders, and General Railway Signal train-control



Class KK-1 single-expansion articulated locomotive built with the Emerson water-tube firebox



Side view of boiler equipped with the Emerson water-tube firebox

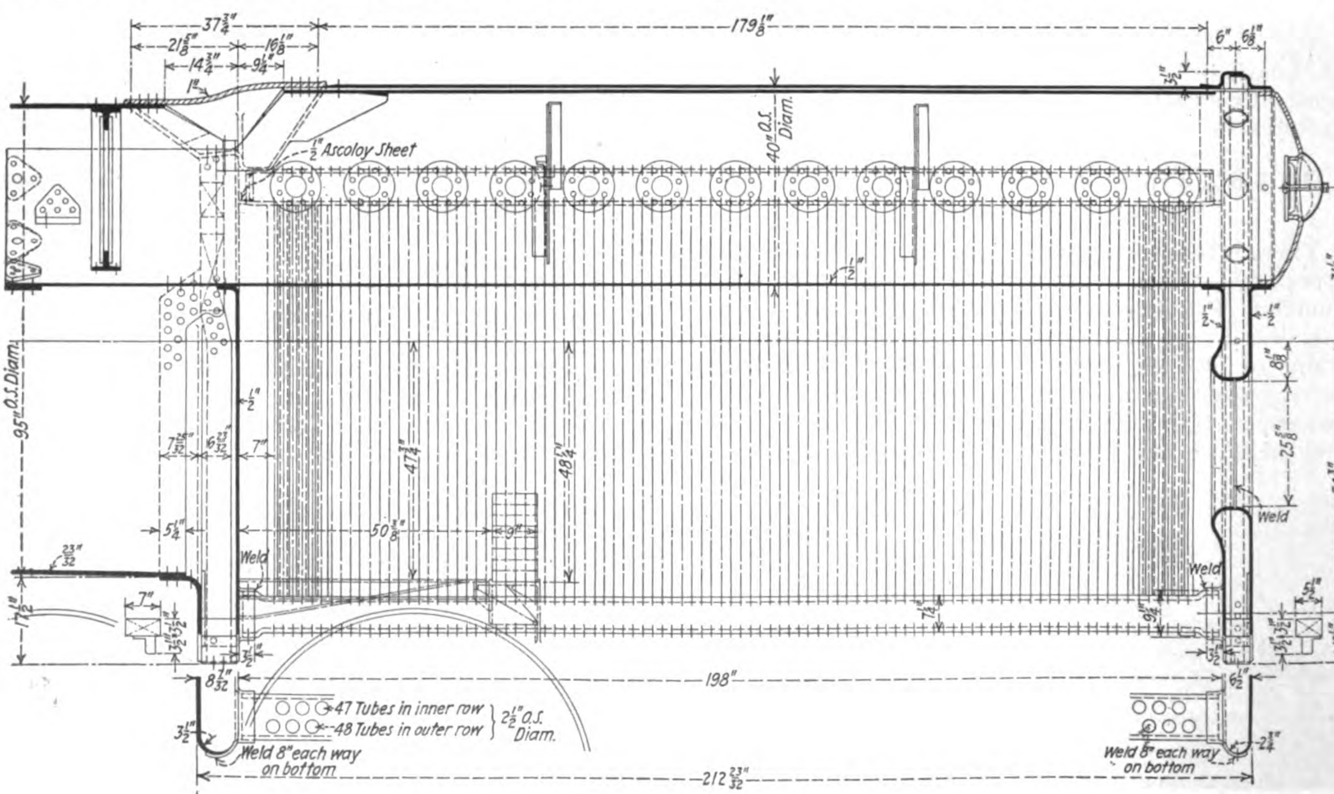
equipment. During the period of the test an Elesco exhaust-steam injector was applied to locomotive No. 5510, Class T-1, and is still applied. Three locomotives, Classes T-1, KK-1 and KK-2, have the Barco power reverse gear, while locomotive No. 5550, Class T-2, is equipped with the Precision gear. A list of the special equipment and appliances on locomotive No. 7400 is shown in one of the tables. The items included in this list are practically the same as applied on the three other locomotives with the exceptions noted.

Average Results of Dynamometer-Car Tests Between Keyser, W. Va., and Brunswick, Md., with Locomotive No. 7400

Number of tests run	3
Season of tests	Winter
Train consist:	
Number loads	96
Number others	1
Total number cars	97
Actual tonnage	8,245
Total time en route	5 hr. 49.6 min.
Road delays	0 hr. 36.4 min.
Net running time	5 hr. 13.2 min.
Average speed, m.p.h.	20.91
Number of stops	3
Total coal as fired	31,500 lb.
Total water evaporated	27,204 gal.
Coal as fired per 1,000 gross ton-miles	35.14 lb.
Coal as fired per sq. ft. grate area per hr.	86.82 lb.
Evaporation, water per lb. coal as fired	7.20 lb.
Coal per drawbar horsepower-hour, as fired	3.14 lb.
Water per drawbar horsepower-hour, actual	22.59 lb.
Average drawbar horsepower	2,546
Average drawbar pull	47,951 lb.
Average boiler pressure, lb. per sq. in.	246.2
Average steam-chest pressure, lb. per sq. in.	216.3
Average back pressure, lb. per sq. in.	3.7
Average cut-off, per cent	42.8
Maximum steam temperature, deg. F.	610
Average B.t.u. per lb. coal as fired	12,994
Per cent moisture in coal as fired	1.74
Overall thermal efficiency at drawbar, per cent	6.25
Pusher used for 8.2 miles over maximum equated grade of	0.85 per cent

The Emerson water-tube fireboxes on the Classes T-1 and KK-1 are designed with a single drum. While different in some details from other designs of water-tube fireboxes which have been applied to other Baltimore & Ohio locomotives, they are designed on the same basic principles.

The preliminary plans for the four locomotives were prepared by the mechanical department of the Baltimore & Ohio, while the details of construction as affecting weight limitations were handled jointly by the builder and the mechanical department of the railroad. The necessity of minimum weight combined with strength



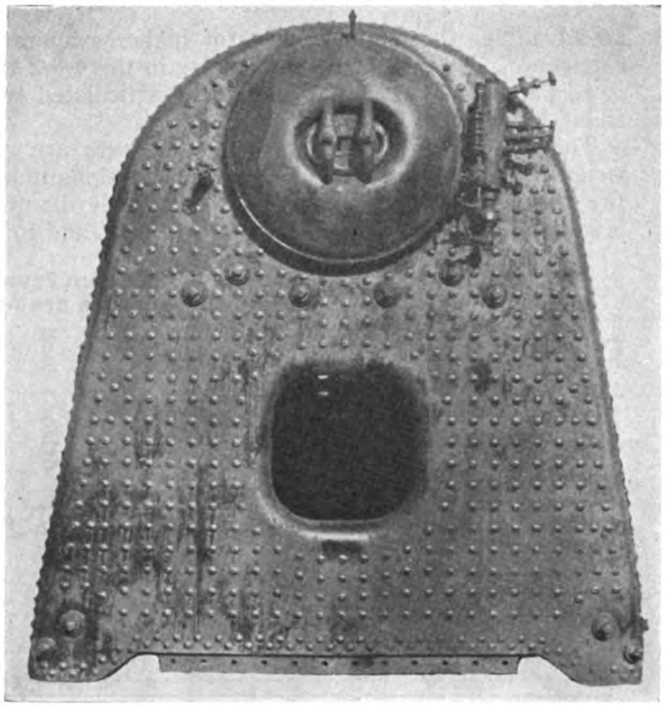
Side elevation of the Emerson water-tube firebox

of parts made it advisable to employ nickel-steel plate in the construction of the boiler shell with special "saw-tooth" butt seams, cast-steel cylinders, single-bar guides, and hollow axles and crank pins. The frames, crossties and bracing members are welded together, practically eliminating the use of joint bolts in the building of the frame structure.

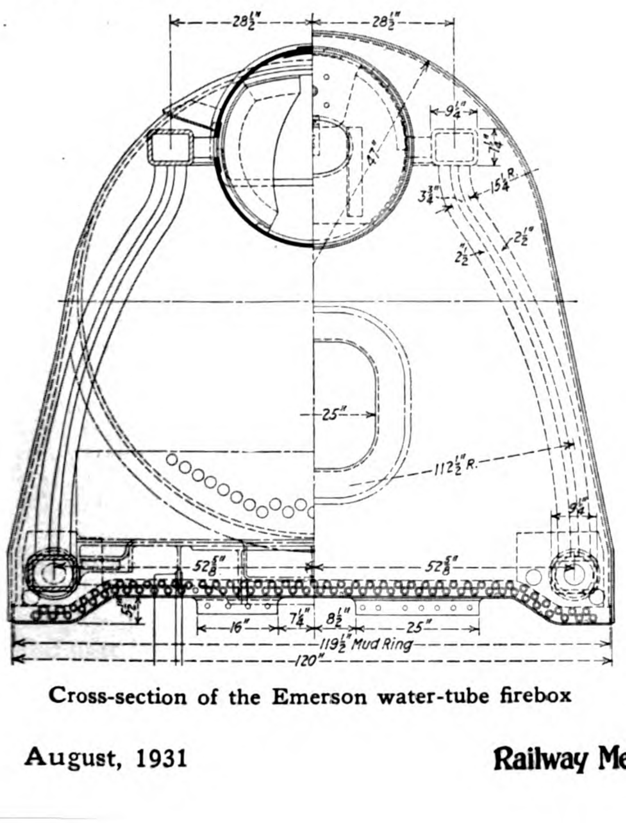
Straight-line running boards and a neat piping arrangement have materially assisted in producing handsome machines. Neatness and convenience have been carried into the back-head and cab arrangement. The cab is of the semi-vestibuled type and provides a seat for the head brakeman. Permanent back doors are provided for entrance, leaving a minimum open space at

List of Special Parts, Appliances and Equipment Applied on the Baltimore & Ohio 2-6-6-2 Type Locomotive No. 7400

Railroad	B. & O.
Service	Freight
Boiler and firebox:	
Blow-off cock	Bird-Archer
Blow-off cock, auxiliary	Coale
Boiler jacket	Bethlehem Steel
Fire brick	Security
Firedoor	Franklin butterfly
Injector, Exhaust steam	Elesco
Injectors and injector check	Sellers
Lagging	Philip Carey
Smokebox hinges	Okadee
Staybolts	Ewald
Stoker	Lower
Superheater	Type A
Tubes and flues	National Tube
Valve, blow-off	Bird-Archer
Valves, safety	Coale
Valve, throttle	Chambers
Washout and arch-tube plugs and bushings	Huron
Cylinders and running gear:	
Bullring, packing and piston head	Locomotive Finished Material
Cradle	General Steel Castings
Driving axles	Standard Steel
Driving boxes	Grisco
Frames, engine- and trailer-truck	General Steel Castings
Lubricators, force-feed	Nathan
Packing, piston-rod and valve-stem	U. S. Metallic
Reverse gear	Barco
Rods, main and side	Standard Steel
Springs, elliptic	Crucible Steel
Valves, blower	Coale
Valves, drain	Okadee
Valves, drifting	Sellers
Valve motion	Walschaert
Wheels, front and back engine-truck	Standard Steel
Cab and miscellaneous:	
Bell ringer	Transportation Devices
Brake equipment	New York Air Brake
Brake shoes	American
Drawbar	Unit Safety
Gage, reflex water	Wiltbonco
Gage, steam	Ashton
Headlight case and generator	Pyle-National
Joints, ball	Barco
Joints, flexible	Barco
Knuckle, emergency	Hynson
Lamps, cab	Pyle-National
Lamps, classification	Armspear
Pipe covering	Insutape
Pipe unions, Dart	Fairbanks
Replacers, car	Buda No. 37
Sanders	U. S. Metallic
Train control	General Railway Signal
Tender:	
Buffer, radial	Franklin
Bumper, back	General Steel Castings
Coal sprinkler	Sellers
Coupler, pilot and tender	National Malleable
Coupler yoke	Buckeye Steel Castings
Draft gear	National Malleable
Frames, truck side	Pittsburgh Steel Foundry
Hose strainers	Sellers
Lamp, back-up	Pyle-National
Truck-box lid	Symington
Wheels	Standard Steel



Back head of an Emerson water-tube firebox applied to a 4-6-2 type locomotive class P9A at the Mt. Clare shops in 1929



Cross-section of the Emerson water-tube firebox

the center which in winter weather can be protected by a curtain.

A maximum of interchangeability between the machinery parts of both types of locomotives is provided. Steam distribution is by Walschaert valve motion of light design, the piston valves of which are 12-in. in diameter. The articulated locomotives are limited to approximately 70 per cent cut-off, while in the 4-8-2 type the maximum is 87½ per cent. The main throttle is located in the dome. The drifting valve is operated by compressed air, and cylinder lubrication is by mechanical means.

Feedwater is supplied by an exhaust-steam injector located on the right side and by a live-steam injector on the left side.

The Emerson Water-Tube Firebox

The fireboxes of the conventional boilers are of large volume, with combustion chambers. The radiant heating surface in the 4-8-2 type is about 9 per cent of the total, while in the articulated type this proportion is less than 8 per cent.

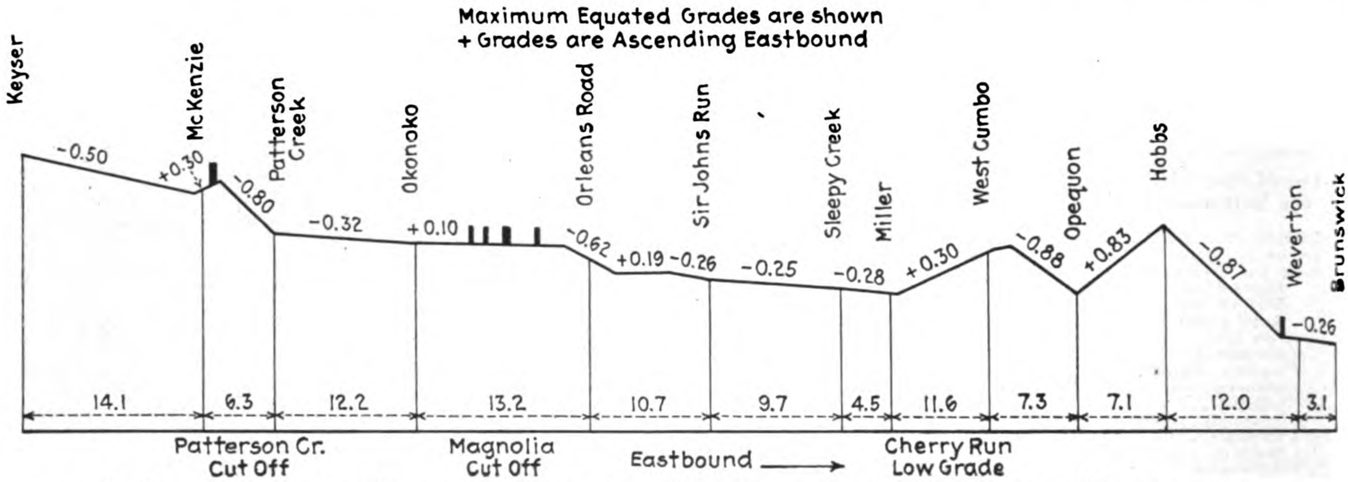
The Emerson water-tube fireboxes of locomotives No. 5510 and No. 7400 considerably increase the ratio of radiant, to convection surface and in this respect show

an advantage that should make for higher evaporative efficiency. The direct heating surface in the 4-8-2 type is 16 per cent of the total and in the articulated type, about 13 per cent.

The boilers with the water-tube fireboxes are constructed with the conventional barrel and longitudinal fire tubes. A single drum, 40-in. in outside diameter, is secured to the back tube sheet at the front, and to the backhead and door sheet at the rear. The back tube sheet is flanged toward the inside to form the riveted connection to the drum, instead of toward the fire side of the sheet. This construction eliminates the double thickness of metal exposed to the radiant heat of the fire. The drum extends rearward and terminates in a bulged head after passing through a back water leg with which it is connected by means of circulating ports. The front water leg is below the drum and is of conventional type as formed by the boiler throat and back tube-sheet.

The front and back water spaces are connected on each side at the bottom with a 5½-in. by 7½-in. seamless rectangular header. Headers of the same size as the top extend along the sides of the drum. The ends of the top headers are blank and have no direct connection with either the back water space or the shell of the boiler.

A total of 190 water tubes, 2½-in. outside diameter, are arranged in two rows between the top and bottom headers. Coarse-thread plugs are located in the top of the top headers opposite the ends of the tubes,



Profile of line between Keyser and Brunswick used for the road tests with the Class KK-1 locomotive

Comparison of Other Baltimore & Ohio Locomotives with the New 4-8-2 and 2-6-6-2 Types Built by the Baldwin Locomotive Works

Railroad	B. & O.	B. & O.	B. & O.	B. & O.	B. & O.	B. & O.	B. & O.	B. & O.	B. & O.	B. & O.
Builder	B. & O.	Baldwin	B. & O.	Baldwin	Baldwin	American	Baldwin	Baldwin	Baldwin	Baldwin
Year built	1924-26	1920-21	1925	1930	1930	1910	1911	1923	1930	1930
Service	Passenger	Passenger	Passenger	Passenger	Passenger	Freight	Freight	Freight	Freight	Freight
Road class	P-1d	Q-4	T	T-1	T-2	E-27ca	Q-1aa	S-1	KK-1	KK-2
Type of locomotive	4-6-2	2-8-2	4-8-2	4-8-2	4-8-2	2-8-0	2-8-2	2-10-2	2-6-6-2	2-6-6-2
Cylinders, diam. and stroke, in.	26½x28	26x32	30x30	27½x30	27½x30	24x30	26x32	30x32	4-23x30	4-23x30
Valve gear, type	Baker	Baker	Baker	Walschaert	Walschaert	Baker	Walschaert	Baker	Walschaert	Walschaert
Valves, piston type, size, in.	......	......	......	12	12	......	......	......	12	12
Maximum travel, in.	......	......	......	7	7	......	......	......	7	7
Outside lap, in.	......	......	......	1⅛	1⅛	......	......	......	1¼	1¼
Exhaust clearance, in.	......	......	......	⅛	⅛	......	......	......	Zero	Zero
Lead in full gear, in.	......	......	......	¼	¼	......	......	......	3/16	3/16
Cut-off in full gear, per cent	......	......	......	87½	87½	......	......	......	70	70
Weights in working order:										
On drivers, lb.	200,000	247,000	275,000	260,000	260,000	202,900	223,600	347,230	372,000	373,000
On front truck, lb.	55,000	22,700	62,000	61,000	62,000	22,000	18,400	31,570	30,000	30,000
On trailing truck, lb.	62,000	57,700	63,000	63,000	63,000	......	40,200	57,710	63,000	63,000
Total engine, lb.	317,000	327,400	400,000	384,000	385,000	224,900	282,200	436,510	465,000	466,000
Total engine and tender, lb.	549,000	541,400	669,000	657,000	658,000	372,970	463,700	734,910	738,000	739,000
Wheel bases:										
Driving, ft. in.	13—0	16—9	19—3	19—3	19—3	16—8	16—9	22—4	34—11	34—11
Total engine, ft. in.	34—8	35—1	41—4	44—7	44—7	25—7	35—0	42—11	56—0	56—0
Total engine and tender, ft. in.	76—5 7/16	74—1½	90—7 11/16	92—11¾	92—11¾	59—8½	71—2 9/16	89—10⅞	104—4¾	104—4¾
Wheels, diam. outside tires, in.:										
Driving	74	64	74	74	74	62	64	64	70	70
Front truck	......	......	......	36	36	......	......	......	36	36
Trailing truck	......	......	......	46	46	......	......	......	46	46
Journals, diam. and length:										
Driving, main, in.	......	......	......	13x13	13x13	......	......	......	12x13	12x13
Driving, others, in.	......	......	......	11x13	11x13	......	......	......	10½x13	10½x13
Front truck, in.	......	......	......	7x12	7x12	......	......	......	6½x12	6½x12
Trailing truck, in.	......	......	......	9x16	9x16	......	......	......	9x16	9x16
Boiler:										
Type	St. Top	St. Top	St. Top	W. T. Fbox.	St. Top	St. Top	St. Top	St. Top	W. T. Fbox.	St. Top
Steam pressure, lb.	225	220	220	250	250	215	190	220	250	250
Fuel, kind	Bit.	Bit.	Bit.	Bit.	Bit.	Bit.	Bit.	Bit.	Bit.	Bit.
Diameter, first ring, inside	78	78	90	89⅝	89⅝	74½	78	90	89⅝	89⅝
Firebox, length and width, in.	120x84	120x84	132¼x96	138x96	138¼x96¼	107⅝x75¼	120x84	132⅛x96	138x96	138⅛x96¼
Combustion chamber length, in.	......	......	......	......	54	......	......	......	......	67
Tubes, no. and diam., in.	......	......	......	260—2¼	59—2¼	......	......	......	260—2¼	59—2¼
Flues, no. and diam., in.	......	......	......	52—5½	224—3½	......	......	......	52—5½	224—3½
Length over tube sheets, ft. in.	21—0	20—5	23—0	20—0	21—0	15—10	21—10	23—0	25—0	25—0
Grate area, sq. ft.	70	70	89.17	92	92.3	56.24	70	88	92	92.3
Heating surfaces:										
Firebox and comb. chamber, sq. ft.	228	228	341	783	361	179.3	228	347	783	383
Arch tubes, sq. ft.	28	35	42	83	18	......	......	42	83	18

Road class	P-1d	Q-4	T	T-1	T-2	E-27ca	Q-1aa	S-1	KK-1	KK-2
Thermic syphons, sq. ft.	......	......	......	......	95	......	......	......	......	95
Total radiant	256	263	383	866	474	179.3	228	389	866	496
Tubes and flues, sq. ft.	3,706	3,550	5,208	4,537	5,015	2,213.4	3,708	4,881	5,677	5,975
Total evaporative, sq. ft.	3,962	3,813	5,591	5,403	5,489	2,392.7	3,936	5,270	6,543	6,471
Superheating, sq. ft.	859	955	1,305	1,340	2,451	425	811	1,510	1,666	2,900
Comb. superheat. and evap., sq. ft.	4,821	4,768	6,896	6,743	7,940	2,817.7	4,747	6,780	8,209	9,371
Tender:										
Water capacity, gal.	13,500	18,000	18,000	18,000	18,000	7,000	9,500	15,800	18,000	18,000
Fuel capacity, tons	19	17½	20	20	20	18	18½	23	20	20
Rated tractive force, lb.	51,000	63,200	68,200	65,000	65,000	50,900	54,600	84,300	90,000	90,000
Weight proportions:										
Weight on drivers ÷ tractive force	3.92	3.9	4.03	4	4	3.94	4.1	4.12	4.13	4.14
Weight on drivers ÷ total weight engine, per cent	63.2	75.6	68.8	67.8	67.5	90.2	79.1	79.4	80	80
Total weight engine ÷ comb. heat. surface	65.8	68.7	58.2	57	48.5	79.7	59.8	64.4	56.7	49.7
Boiler proportions:										
Tractive force ÷ comb. heat. surface	10.6	13.25	9.9	9.65	8.2	18.1	11.5	12.4	10.95	9.6
Tractive force × diam. drivers ÷ comb. heat. surface	784	848	732	714	606	1,124	739	795	768	673
Firebox heat. surface ÷ grate area	3.66	3.76	4.3	8.51	3.91	3.19	3.26	4.43	8.51	4.16
Firebox heat. surface, per cent of evap. heat. surface	6.46	6.9	6.85	14.43	6.58	7.53	5.8	7.38	11.97	5.92
Superheat. surface, per cent evap. heat. surface	21.6	25.2	23.4	24.75	44.7	42.8	20.6	28.7	25.6	44.7

convenient for rolling in and also for turbining the tubes at washout periods. Construction plugs are used in the bottom of the bottom headers for convenience in rolling in the tubes. However, these plugs are not removed at the time tubes are turbined. The top headers are connected to the drum along each side with a series of 13 short nipples 4-in. in outside diameter. A shallow pressed-steel hip sheet joins the top portion of the drum to the boiler shell. Insulation is applied between the drum and the upper side headers and over the water tubes at the sides.

The water-tube firebox in locomotives Classes T-1 and KK-1 effected a substantial increase in heating surface over the stayed firebox without increasing the weight. For example, the water-tube firebox has an evaporative heating surface of 866 sq. ft. as compared with 474 sq. ft. of evaporative surface for the stayed fireboxes, including the syphons—an increase of 82 per cent. To increase the heating surfaces of the stayed fireboxes to obtain the same heating surface as the water-tube fireboxes, the additional weight would have required a four-wheel trailing truck, and furthermore would have increased the total weight of the locomotive to such an extent as to prohibit operation over a number of divisions. The water-tube fireboxes have large combustion chambers, part of which can be conveniently used for increasing the grate area if desired.

The Tenders

The Vanderbilt type tenders are of light construction, having a tank capacity of 18,000 gal. and a bunker capacity for 20 tons of coal. The frame is combined with the bottom tank sheet. The tender weighs 273,000 lb. loaded; 2.16 lb. of coal and water carried per pound of light tender.

Road Tests of the No. 7400

A series of road tests with a dynamometer car were made with the 2-6-6-2 type locomotive, No. 7400, which is equipped with the Emerson water-tube firebox. These tests were made in slow-freight service eastbound on the east end of the Cumberland division, between Keyser, W. Va., and Brunswick, Md. This is not the operating territory for which the locomotive was designed, but is the division regularly used by the railroad for road tests. The profile of this part of the line, shown on one of the drawings, is especially adapted for road tests. Owing to the fact that other locomotives have been tested over this same line, a comparison with other performances can be readily made.

The distance from Keyser to Brunswick is approximately 112 miles. Between Opequon and Hobbs, a distance of seven miles, there is a ruling grade of .73 per cent with a maximum curvature of 4 deg. Helper service is required between these two points.

The trains hauled during the tests averaged 9,700 adjusted tons. The trains were made up of loaded 50- and 70-ton coal cars. The average results of these tests are shown in one of the tables. Several preliminary runs were made to determine the correct size of nozzles which would properly draft the engine for this service. Two 5½-in. open exhaust nozzles gave the best results.

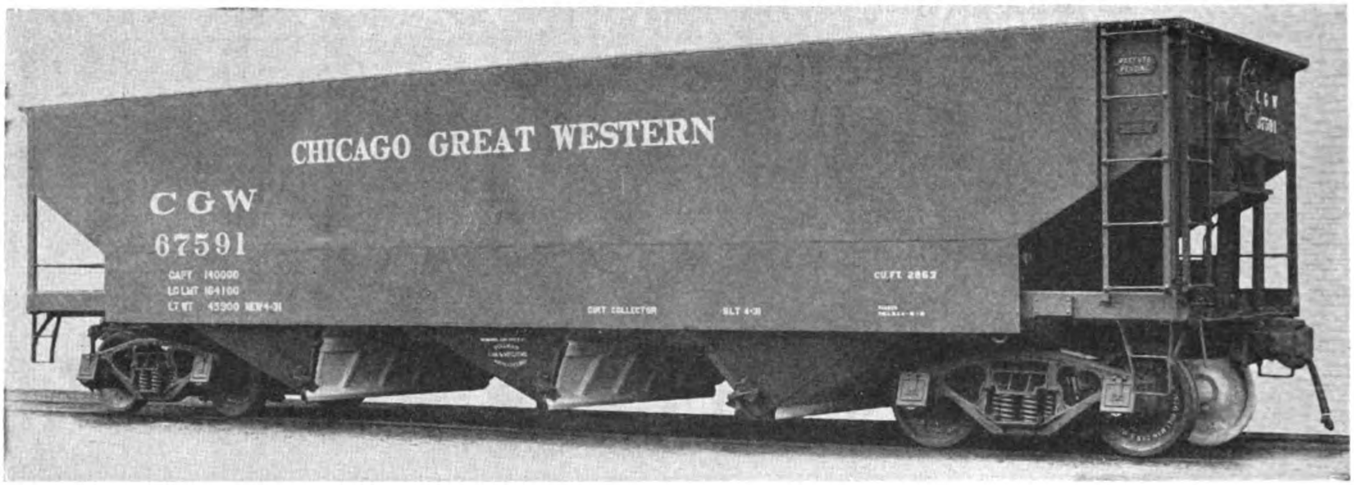
A study of the figures given in the table shows that exceptional economy was obtained, both in coal and water consumption. The coal and water consumption per drawbar horsepower per hour affords an accurate basis for this conclusion. This economy is also reflected in the high over-all thermal efficiency obtained at the drawbar.

A relatively high average speed was maintained over the division, together with an average drawbar pull of approximately 48,000 lb., indicating that the large driving wheels were a distinct advantage in maintaining a fast schedule for tonnage trains.

Owing to the fact that an apparently large drop in pressure between the boiler and steam chest is shown, some explanation in regard to the source of these figures is necessary. The averages include the steam-chest pressures observed while the locomotive was working with a restricted throttle opening for short periods. With full throttle opening and under good operating conditions, this drop was observed to be only about 10 lb. A study shows that the two units of the engine are well balanced, developing approximately the same horsepower. Although indicator cards were not taken with the object of determining maximum horsepower, they show that this would be reached at a speed well above 35 miles an hour.

As a result of these tests it is evident that a single-expansion articulated locomotive of the 2-6-6-2 type with 70-in. drivers will meet the actual load and clearance restrictions imposed, afford sufficient boiler capacity for cylinder requirements and give economical performance.

Dining Car Murals Honor Pioneers.—Mural decorations in the three new air-cooled dining cars recently constructed for the Missouri-Kansas-Texas will pay tribute to pioneers of the Southwest. Three of the panels, which will be identical in each car, represent the spirit of transportation—the covered wagon, the early train, and the pony express rider. The fourth panel depicts the Alamo. The panels also contain the state seals of Kansas, Oklahoma, Missouri, and Texas, respectively.



One of five all-welded hopper cars recently built by the Pullman Car & Manufacturing Corporation

C. G. W. All-Welded Hoppers Built by Pullman

Cars are the largest in capacity and the lightest in weight of any hoppers on 6-in. by 11-in. journals

WITH the primary object of developing a coal car to produce more revenue per pound of weight on the rails, the Chicago Great Western consented to have five units of its orders for 300 70-ton hopper cars, placed with the Pullman Car & Manufacturing Corporation in the latter part of 1930, built to a design proposed by the car builder and embodying, among other features, practically all-welded construction. These cars, recently completed and delivered to the railroad, weigh 45,900 lb. each, or roughly only as much as 50-ton cars of riveted construction. This means that 20 additional tons of coal can be carried in each car at no greater transportation expense for the movement of tare, or dead weight.

On the basis, both of reduced light weight and of increased capacity, the welded car shows marked superiority. With a light weight of 45,900 lb., it provides a cubic capacity (level full) of 2,863 cu. ft. As compared with the heaviest riveted car in the accompanying list of typical 70-ton hopper cars of recent riveted design, the welded car weighs 10,500, or 18.6 per cent. less, and at the same time provides 85 cu. ft., or 3.1 per cent, greater cubic capacity, all of which is available for carrying increased revenue load. As compared with the lightest riveted car in the list, this is a decrease of 4,300 lb., or 8.6 per cent, in light weight, a notable reduction, in view of the fact that a gain of 243 cu. ft., or 8.9 per cent, in cubic capacity is made at the same time. On the basis of $100 increased earning power per ton per year, it is anticipated that the 70-ton welded car will produce, on the average, $400 more revenue per year than one of equal nominal capacity but incorporating ordinary riveted construction.

Body Design a Distinct Innovation

The Chicago Great Western 70-ton welded hopper car is of the conventional three-hopper type, with standard four-wheel trucks and 6-in. by 11-in. journals, but the body design is a distinct innovation, no cars having previously been built with the type of construction and amount of welding used in these cars. The entire body of each car, including a one-piece welded tubular steel center sill, is assembled by welding, and the only rivets used are those for fastening safety appliances, draft-gear supports, door hooks and similar parts subject to breakage or periodic removal. Even the pipe joints are made by welding, and that process is used to attach and anchor the train line and connecting pipes to the car body.

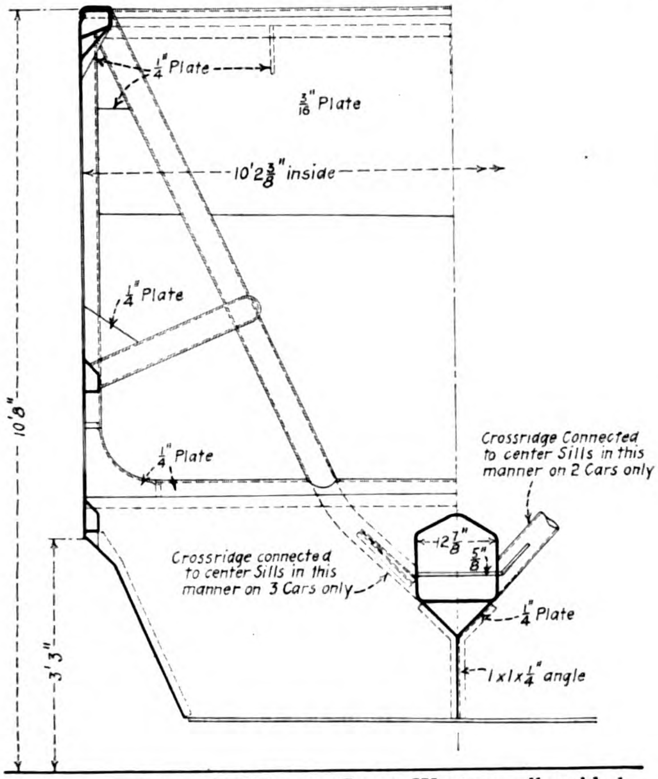
Both oxyacetylene and electric arc welding are used in the manufacture of these cars; the former on the heavier sections where strength and ductility of weld metal is the prime essential, and the latter on the light sheets where the lower heat of the arc reduces the probability of warpage.

Welding Operations Checked and Cars Tested

There are approximately 1,500 lin. ft. of welding in the car. Of the 200 lb. of welding rod required, 56 per cent is deposited by the oxyacetylene process and 44 per cent by the electric arc. The former method is used for the following parts: Center sill and all attaching parts; body bolster and all attaching parts, including side and floor sheets; all-pipe cross ridge; lower end construction; floor sheets, except where joined to the side and end construction; all pipe joints and pipe anchorage. The following parts are welded with the electric process: All side-sheet construction; all upper end construction; all dump doors. The Oxweld Railroad Service Company co-operated with the Pullman Car & Manufacturing Corporation in refining design details to meet the welding requirements and in the

supervision of the performance of the actual welding operations.

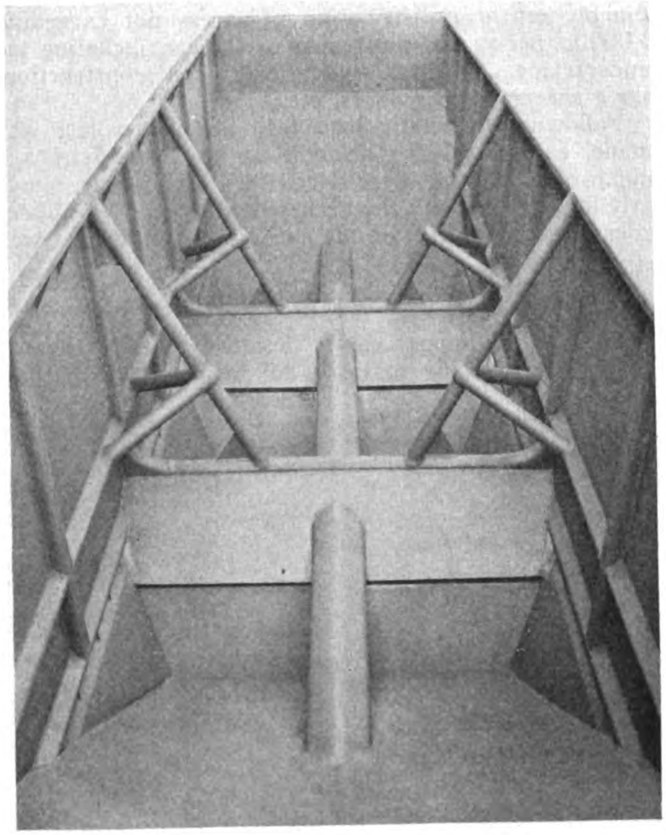
Before beginning welding operations on the new cars, extensive tests, covering a period of several weeks, were made to determine the relative efficiencies and costs of various types of welded construction required in the fabrication and assembly of the car parts. Experienced operators were used for both the oxyacetylene and the electric welding operations, these operators being required to submit test specimen welds at intervals as a check on the quality of their work. In addition, all welds were hammer tested during the course of construction, with two objectives, namely, to distribute local stresses and to permit the immediate



Cross-section of Chicago Great Western all-welded 70-ton hopper car

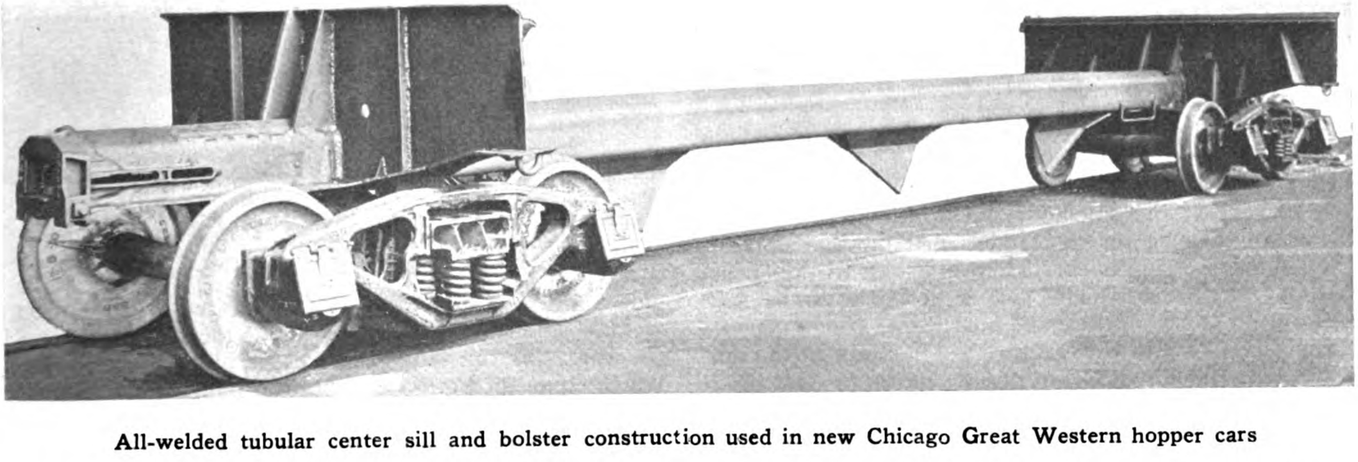
correction and reinforcement of any welds which gave indications of weakness.

Upon the completion of each car, it was painted with a cement wash, which was permitted to dry, and the car was then loaded with sand until its total weight on the rails was 210,000 lb. This load filled the car only to within 10 in. of the top, consequently being concentrated over a smaller area than would be the case with coal loading, and introducing stresses in excess of any likely to be encountered under normal operation. A careful examination of joints gave no indication of the cement flaking off due to working of the joints or movement of the plates.



The interior construction of the all-welded hopper car—Patents are pending on a number of features embodied in the construction of these cars

In addition to this practical test for stresses beyond the elastic limit, the loaded car was thoroughly tested with extensometers to measure the elongations and to determine the relative stresses within the elastic limit encountered in various car parts. The use of the extensometers showed uneven stresses in certain parts of the car on the first loading, as, for example, around the bolster, which was reinforced and another test made. Certain plates also showed excessive stress on the initial loading, which was equalized on subsequent applications. As finally tested, each car showed a rea-



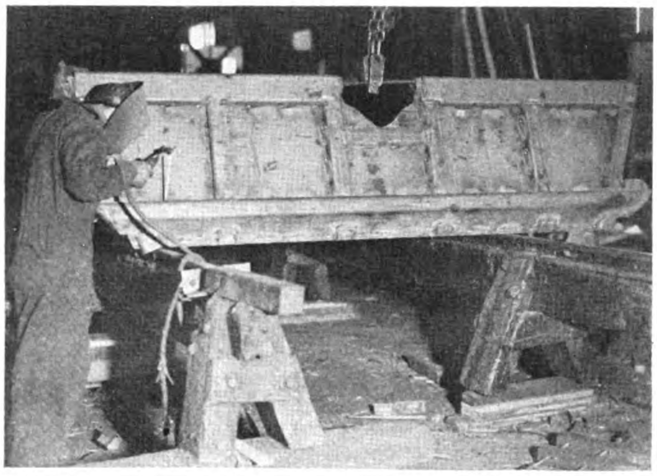
All-welded tubular center sill and bolster construction used in new Chicago Great Western hopper cars

sonably uniform distribution of stress not exceeding 9,000 lb. per sq. in. in all parts of the car, including the underframe, bolsters, side sheets, end construction, slope sheets, hopper doors, etc.

Following the static load test, an impact test was made, each car being brought up to a speed of 5½ m.p.h. and allowed to collide with a second car, similarly loaded, but with the brakes lightly set. No noticeable permanent effect on the structure of either car was apparent.

General Method of Construction

The welded hopper car is designed to take advantage of the welding to tie in all members so that all



Hopper door fabricated by electric arc welding

parts of the underframe and superstructure act as a unit in resisting draft, buffing and load stresses. Pressed shapes, with large radii at the corners, are used, these shapes lending themselves to the welded construction much better than the usual structural shapes, and having the additional advantage of being light in weight. When welded to the sheets, they form box sections of greater strength per unit of weight than the usual structural shapes used in riveted cars. Flanges are largely omitted, not being required for the application

General Dimensions of Chicago Great Western All-Welded 70-Ton Hopper Car

Length over strikers	42 ft. 0 in.
Length over end sills	41 ft. ⅜ in.
Height, rail to body center plate	2 ft. 2¾ in.
Side bearing centers	4 ft. 2 in.
Distance between truck centers	32 ft. 0 in.
Truck wheel base	5 ft. 8 in.
Length inside	41 ft. 0 in.
Width inside	10 ft. 2⅜ in.
Width over side sheets and overall	10 ft. 2¾ in.
Height, rail to top of side plate	10 ft. 8 in.
Cubic capacity level full	2,863 cu. ft.
Cubic capacity with 10-in. average heap	3,197 cu. ft.
Light weight of car—lb.	45,900 lb.
Revenue load with 10-in. average heap—lb.	164,000
Total weight on rail—lb.	210,000

of rivets. The stakes are placed inside the car and the side sheets brought out to the line of the riveted car to give maximum capacity. This construction requires the corners at the sideladder to be offset inwardly to provide clearance for the ladder. At the end opposite the ladder, the side is carried straight out to the corner without any offset. The car is designed to be self-clearing in every respect, the absence of rivets contributing effectively to this feature. All joints in the coal space are made with continuous welds so that there are no openings to permit the entrance of moisture and dirt and promote corrosion. In addition, the slope sheets are given a pitch of 1¼ in. from the sides toward the center, in order to drain water away from the corners where corrosion takes place. In addition, this construction tends to keep the center of the load moist and assist in unloading.

The body bolster is built up with a bottom cover plate and a web plate with proper flanges at the top for supporting the floor sheets. The sides are made of two sheets, joined with a continuous butt weld for their entire length. This provides a heavy sheet where the corrosion and hammering is most severe and saves considerable weight where the greater thickness is not required.

The side still is formed of a plate in a channel shape in one piece from bolster to bolster. The side-sheet stif-

Typical 70-Ton Hopper Cars of Comparatively Recent Design

Road	Light Weight	Cu. Cap. Level Full	Cu. Cap. 10-In. Heap
New York Central (three hoppers)	50,200	2,620	2,948
D. L. & W. (three hoppers)	50,800	2,755	3,062
N. & W. (four hoppers)	51,500	2,439	2,729
C. G. W. (three hoppers)	52,675	2,778	3,100
C. M. St. P. & P. (four hoppers)	52,800	2,778	3,100
B. & O. (four hoppers, A.R.A. design)	52,900	2,736	....
C. & N. W. (four hoppers)	54,900	2,590	2,900
I. C.	56,400	2,778	3,100
C. G. W. (All-welded, three hoppers)	45,900	2,863	3,197

fener is of the same section as the side sill, being located at the joint between the upper and the lower side sheets. This locates the stiffener at approximately one-third the height of the side where the bulging is greatest and where the hammering occurs to loosen freezing loads. These stiffeners run between the stakes and are welded to the stakes and side sheets with a continuous weld.

The side plate is formed of ¼-in. plate in much the same shape as the side sill, but, in this case, the top flange is straight and the lower flange is sloped downwardly. The lower flange butts against the top side sheet. The upper flange has a small flange at 45 deg. to provide for lining up with the top of the side sheet which has a small flange bent inwardly at 45 deg. The

Applying a center plate by oxy-acetylene welding to supplement the riveting also used in this instance

side plate is joined to the side sheet with intermittent welds. The side plate is continuous the entire length of the car. At the ladder pocket, a plate is introduced which joins to the top and bottom flanges and the side sheet, providing clearance for the ladder.

The side-plate gussets, of ¼-in. plates, are located be-

tween the stakes, approximately 3 ft. apart, to provide further stiffening and connections between the side plate and side sheet.

Side Stakes Made in Channel Shape

The side stakes are formed in channel shape. There are seven stakes per side, all but the bolster stakes being rectangular in section. The bolster stakes have the flange towards the end of the car at an angle to provide for clearing the lading. The bolster stakes extend from the slope sheet to the side plate. A ¼-in. plate, 14 in. wide, extends from approximately 12 in. above the slope sheet to the side sill and is flanged under the bolster. The stakes are joined to the side sheets with continuous fillet welds.

The cross ridge extends across the car in one piece, with a gusset pressing of approximately the same cross section at the sides. Connection plates support the cross ridge at the center sill. The upper end of the gusset piece is formed in rectangular shape to join with the side stake.

The cross-ridge gusset is formed of 4-in. standard pipe, extending from the side plate through the cross ridge to the center sill. Longitudinal bracing is provided by two pieces of 4-in. pipe at 60 deg., extending from the side-sheet stiffener to the cross ridge gusset. Gussets, of ¼-in. plate, are placed between the cross ridge and the pipe, and the side stake and pipe at the side plate. Horizontal gusset plates are placed between the pipe and the center sill.

The end sheet is a $\frac{3}{16}$-in. plate with a small flange at the bottom to take the slope sheet and the same flange as the side sheets at top for connection to the end plate. This flange extends outwardly on the end sheets, however, as the end plate is placed outside the car. The end plate is the same section as the side plate, the bottom flange being offset at the end ladder to provide proper clearance.

The corner posts are structural angles joined to the end and side sheets with intermittent welds on the outside and continuous welding inside the car. The end posts are structural channels joined to the end sheet with continuous welding.

The end sill is a structural angle welded to the center sill and to the end and corner posts. The sub side sill is a channel pressing with the flanges inward. There are no offsets in this member, which extends in a straight line from the end sill to the bolster web, to which it is welded. Diagonal braces of ¼-in. plate, pressed in channel shape with the flanges down, extend from the corner to the center sill at the bolster, being welded in place.

Hopper Sides, Door and Hinge Construction

The outside hopper sides have a small flange to take the floor sheets and the edge at the door is pressed in a Z-shape, as is usual in hopper cars. These sheets are welded to the extension of the car sides, which are carried down 1 in. below the side sill for this purpose. One-quarter-inch gusset plates are placed between the side sill and the hopper sides, approximately 2 ft. apart.

These cars have a single inside hopper sheet on the center line of the car, the completed sheet is Y-shape, one plate extending from the edge of the center sill to the bottom, forming one side and the leg of the Y. A relatively short plate extends from the other side of center sill to the first sheet, forming the V-shaped opening in the upper part of the Y, through which the brake rod passes.

Three hopper doors are provided per car, in place of six, as in the usual practice. Each door is made of flat ¼-in. plate, with a channel-shaped stiffener of ¼-in. and $\frac{3}{16}$-in. plate, welded to it with intermittent welds. The doors are arranged for the application of hooks for holding them in the closed position.

New Type Hopper-Door Hinge

The hopper-door hinge is a new type, being continuous from the side to the center sill on each side of the car. The hinge butt is a channel-shaped pressing of ⅜-in. plate. The top flange is welded to the floor sheet, forming a stiffener for the edge of the sheet. The lower flange is formed to fit a 1¼-in. pipe and the door sheet is flanged to fit over this pipe. The door is applied by placing it in position and inserting the 1¼-in. pipe from the side of the car, after which a plate is welded to the outside which holds the pipe in place. The pipe prevents the door's becoming unhinged and forms the pin around which the door works. Continuous support is given the door, and this weight is distributed evenly along the edge of the floor sheet.

The floor sheets are of ¼-in. plate without flanges. They have a transverse slope, being 1¼ in. lower at the center line of the car than at the sides. The long slope sheets are in two pieces, welded on the longitudinal center line of the car. The cross-ridge sheets are in one piece from side to side, notched to fit around the center sill. All floor sheets are welded to the center sill and sides. A channel-shaped stiffener of ¼-in. pressed plate is provided under the lower edge of the slope sheets at the door opening.

The brake fulcrum brackets and lever guides are welded to the center sill. The brake-cylinder brackets are flanged plates welded to the bolster, diagonal brace and center sill. The auxiliary-reservoir brackets are welded to the bolster and to center sill and diagonal brace. The brake cylinder and reservoir are bolted to the brackets to provide for ready removal. The piping for the brake system is welded without couplings or fittings except where fittings are necessary for the removal of parts, such as triple valves, pressure retainer, etc.

The cars are arranged for standard draft gear with horizontal yoke. The back stop and bolster center filler is a steel casting with lugs on the side which engage slots in the sides of the center sill. The opening between the lugs and the center sill web are closed by welding, which makes the casting an integral part of the center sill. On the bottom of the casting are lugs which extend through the bottom bolster plate and the body center plate. These holes around the lugs are filled by welding, which makes the center plate practically a unit with the center filler casting and center sill.

The cheek plates are steel castings, which, in addition to the flanges for the draft keys, have lugs which engage slots in the center sill. These lugs, as well as the draft-key supporting flanges, are welded to the center sill, forming a unit with it.

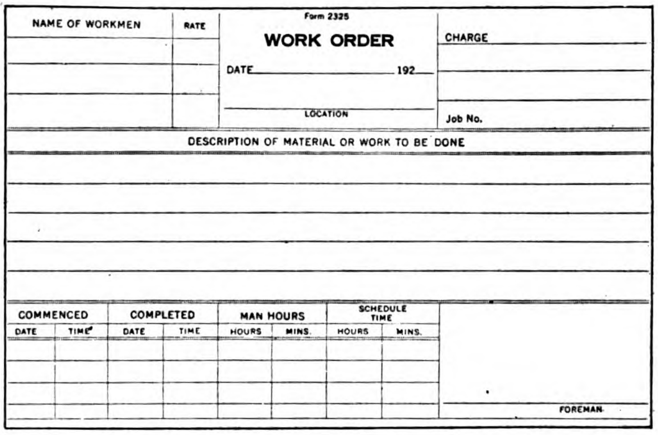
The striker is a steel casting arranged to fit over the end of the center sill, with surfaces to butt the end of the sill. The welding makes this casting an integral part of the sill.

Fifty Years Ago.—The important subject of car couplers which will protect switchmen will be considered by the coming convention of the master car builders, although there is a natural disinclination on the part of the association to officially endorse any particular device from fear of benefiting some inventor.—Railway Age, May 26, 1881.

Shopping Union Pacific Locomotives

Increased reliability and serviceability and reduced unit maintenance cost are objectives of system policy

SINCE 1923, the Union Pacific Railroad, and subsequently all four units of the Union Pacific System, had been following a policy of periodic monthly inspection and conditioning of locomotives, generally conceded to be one of the most important single factors in the successful extension of locomotive runs with their attendant operating economies. Between 1924 and 1931 locomotive utilization, measured in miles per active locomotive per month, increased 10 to 15 per cent; mileage between shoppings for general repairs, 80 per cent or more, and locomotive-miles per failure, over 100 per cent, a striking accomplishment in view of the greatly increased severity of the service due to higher train speeds, heavier trains and increased tractive force, as shown in one of the tables. The remarkable decrease (50 per cent in four years) in the number of locomotives found with federal defects also reflects a great improvement in motive-power conditions.


Form 2325
WORK ORDER
NAME OF WORKMEN | RATE
DATE ____ 192__
LOCATION
CHARGE
Job No.
DESCRIPTION OF MATERIAL OR WORK TO BE DONE

COMMENCED		COMPLETED		MAN HOURS		SCHEDULE TIME	
DATE	TIME	DATE	TIME	HOURS	MINS.	HOURS	MINS.

FOREMAN

Combination work order and individual job check, filled out by foreman

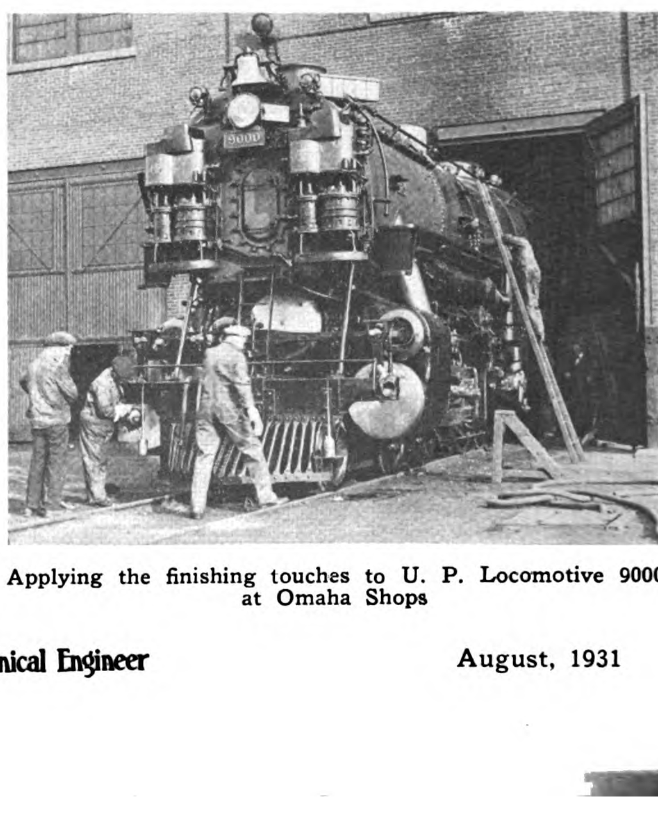
In conjunction with the careful monthly conditioning of locomotives at engine terminals and the greatly increased mileage between heavy repairs, the Union Pacific instituted in 1927 a program of concentrated attention on relatively fewer motive-power units undergoing repairs at one time in each shop, with the result that the average shopping time on heavy power was cut from 43 to 19.8 working days per locomotive given Class 2 repairs; 30 to 14.6 days for Class 3 repairs, and 20 to 8.6 days for Class 5 repairs.

A production time study system was also installed in the shops, providing a more accurate knowledge of conditions and an incentive for improvement not previously available. Effective labor-saving devices and methods developed at each system shop were applied to others, an improved standard-practice folio being developed. Friendly competition, as well as an interchange of ideas, was stimulated between the respective shop points, shop efficiency being proportionately increased. Without any sacrifice of quality and in spite of a large amount of betterment work, such as the application of locomotive bed castings, feedwater heaters, etc., the man-hours per Class 3 repairs on heavy Pacific type locomotives were cut from 6,000 in 1924 to 3,712 in 1931. Class 2 repairs dropped from 6,500 to 4,300 man-hours in the same period. Class 3 repairs to a 2-10-2 type locomotive required 5,400 man-hours in 1924 and only 4,500 man-hours in 1931.

Concentration, specialization, and modernization are three words which perhaps best describe the present locomotive shopping policy of the Union Pacific. Heavy maintenance operations on the system are concentrated essentially at five major shops; namely, Omaha, Neb., Cheyenne, Wyo., Pocatello, Idaho, Portland, Ore., and Los Angeles, Cal. In addition, Class 4 and 5 repairs are handled quite extensively at nine intermediate repair shops, which compares with nearly 25 intermediate points formerly making all classes of repairs.

Shop Production Time Study Produces Results

A notable improvement in the standards of shop machinery and labor-saving equipment has been accomplished on the Union Pacific in recent years. Typical new equipment installed includes machine tools, welding equipment, heating furnaces, electric drop pits, power-operated crane trucks, pneumatic tools, etc., which are such a vital factor in efficient shop production. Grinding machines, in particular, have proven their value in providing accuracy, smooth finish and minimum stock removal. All new crank pins, for example, are finished by grinding and crank pins, not removed from the wheel centers, are ground by means of a portable machine. With floating-type bushings, accurately finished, the



Applying the finishing touches to U. P. Locomotive 9000 at Omaha Shops

service life of these bearings has been practically doubled, effecting large savings in labor and material costs as well as locomotive out-of-service time.

The results of the system of shop production time study, started in the Union Pacific Railroad locomotive department in 1927 and subsequently extended to all major and intermediate repair points on the system, have already been outlined. The principal feature of the system is its simplicity, only four forms being required and the general direction being provided by one production supervisor and three assistants for the system.

The purpose of the production system is to increase unit shop production without the overhead expense involved in handling work under a bonus system. Shop supervisors know at a glance how long detailed repair operations are taking compared to what can be done. Shop men are specialized to as great an extent as practical and provided with the tools, working conditions and facilities needed for most efficient operation. Moreover, a knowledge of what is being accomplished by other men in the same shops or by other shops on the system creates a feeling of friendly rivalry in the development of improved methods and labor-saving devices. Emphasis is placed on a high standard of workmanship which is the first consideration.

When this system was first inaugurated it was found that some supervisors had little accurate knowledge of the man-hours required for various operations performed under their direction and in their departments and in many cases two men were assigned to do one man's work. Supervisors are now careful to study and assign jobs to men who are best adapted to the respective classes of work and they also see that on jobs requiring more than one man, only the number of men required to perform the work with safety and efficiency are used.

Form 7004

UNION PACIFIC SYSTEM

SCHEDULE JOB SHEET

C. S. 11-25-10,000 Temporary Form 42 (Revised)

DESCRIPTION ________ Group No. ________

________ Job No. ________

U. P. R. R.						O. S. L. R. R.						O. W. R. R. & N.						L. A. & S. L. R. R.							Schedule Time	
Location	No. of Jobs	Time Total Hrs	Time Total Mins	Time Aver. Hrs	Time Aver. Mins	Location	No. of Jobs	Time Total Hrs	Time Total Mins	Time Aver. Hrs	Time Aver. Mins	Location	No. of Jobs	Time Total Hrs	Time Total Mins	Time Aver. Hrs	Time Aver. Mins	Location	No. of Jobs	Time Total Hrs	Time Total Mins	Time Aver. Hrs	Time Aver. Mins		Hrs	Mins

Master form showing number of jobs checked and comparative times for individual shops on the system

Typical Machinery and Shop Equipment Installed on the Union Pacific During the Past Three Years

Arc welders
Horizontal boring machines
Portable boring bars
Radial drills
Flue cutters
Flue welders
Heating furnaces
Swing grinders
Crank pin grinders
Steam hammers
Axle burnishing lathes
Car axle lathes
Journal turning and quartering lathe
Engine lathes
Turret lathes
Pipe threading and bending machines
Hydraulic shapers
Upsetting and forging machines
Tilted sandblast machines
Veneer press
Electric drop pits
Pneumatic wrenches and other small tools
Crane-type trucks
Lift trucks
Skids and material-handling boxes

The locomotive maintenance work is divided into seven departments, including the boiler, machine, erecting, blacksmith, pipe and jacket, electric, and miscellaneous departments, each of which has an over-all assignment of schedule man-hours for ten individual classes of locomotives. In addition, the detailed maintenance operations are divided into groups numbered from 10 to 99 and including approximately 7,000 jobs for each of the ten classes of power.

Comparison of Present and Former Monthly Locomotive Mileage and Mileage Between General Repairs

Type	Locomotive-miles per month: 1931	Locomotive-miles per month: Prior to 1929	Miles between general repairs: 1931	Miles between general repairs: Prior to 1929
Heavy Pacific	9,210	8,300	211,000	165,000
Mountain	7,700	7,200	226,000	180,000
Consolidation	2,550	2,100	76,000	60,000
Mikado	4,450	4,000	89,000	60,000
Mallet	3,870	3,300	93,000	40,000
2-10-2	5,800	5,300	98,000	75,000
4-12-2	6,500	6,200	152,000	125,000

The four forms mentioned include a work order and individual job check filled out by the foreman, one form on which information from the individual job check forms is consolidated, another form which gives the comparative performance of individual units of the

(Concluded on page 411)

Form 7120

C. S. 1-30-11,000

UNION PACIFIC SYSTEM

________ COMPANY

TEST JOB CHECKS ________ DEPT. DATE ________ 193__

Group No.	Job No.	Location	Operation	No. of Jobs	Class of Eng. or Car	Total Time		Average Time		Schedule Time		Change Recommended		Remarks
						Hrs.	Mins.	Hrs.	Mins.	Hrs.	Mins.	Hrs.	Mins.	

Consolidation form for data drawn from individual job check slips

Fluid-Film Lubrication as Applied to Journal Bearings

By F. O. Willhofft*

Abstract of a paper presented at the Fifth Oil-Power Conference which was held at Penn State under the joint auspices of the college and the Lubrication Engineering Committee of the Petroleum Division, A.S.M.E.

THIS paper is restricted to partial bearings, of the A. R. A. type, which are subjected to a load acting on the top of the bearing. The loads are comparatively high, nominal loads varying between 355 and 385 lb. per. sq. in. of projected area, and actual loads reaching values as high as 485 lb. per sq. in. The maximum rubbing velocity may be as much as 1,200 ft. per min. or more.

Until recent times the knowledge possessed by the average engineer, both operating and designing, concerning the theory of lubrication was somewhat hazy. Text books stated that there were three kinds of friction, solid friction, semi-fluid friction and fluid friction, but information about the basic laws was decidedly fragmentary and inconclusive. Usually a number of tests were cited, giving numerical values for the coefficient of friction under certain conditions, but no information seemed to be available which would assist an engineer in designing a bearing so as to give the best results with any given combination of variables. Any one who seriously attempted to acquaint himself with the theory of lubrication was immediately confronted with mathematical formulas which staggered even those who had not altogether forgotten the differential calculus of their school days. Worse still, these formulas seemed to have no direct bearing upon actual practice any more than the results obtained on the so-called friction testing machines found in college laboratories.

Fortunately, we have quite a different state of affairs today; A mere glance at the reports of the A. S. M. E. Special Research Committee on Lubrication will disclose how much has been done during the last few years in the analytical and experimental investigation of lubrication problems. All engineers interested in lubrication owe a great debt of gratitude to this committee, not only for the exhaustive and systematic compilation of all the information available on the subject but also for the valuable work contributed by the individual members of the committee and the stimulus they have given to the industries interested in lubrication problems.

Vast Amount of Work Remains To Be Done

A vast amount of work still remains to be done. Of greatest immediate importance to industry are the experimental investigations now under way or being planned for the purpose of determining actual oil-film pressures on bearings of commercial size and design, and with methods of lubrication and working conditions duplicating those prevailing in practice. The earlier tests were mostly made on small bearings and under arbitrary laboratory conditions, thus being of little immediate usefulness to the student trying to collect practical data. The fact that means have been found to finance the necessarily costly experiments on bearings of commercial sizes constitutes a welcome acknowledgement of the importance of the problems of lubrication and of the need of additional information.

A pressure gage speaks a language which every engineer understands, even though he is unable to follow or can only partially digest the writings of Reynolds, Petroff, Harrison, Sommerfeld, and other pioneers in the field who have laid the foundation for or developed the theory of film lubrication. The experimental investigations of actual bearing conditions, now under way at various places here and in Europe, and of which the work done by Professor Bradford[1] at State College, Pa., is a splendid example, will furnish us with practical cofficients for the theoretical equations or may even necessitate the formulation "of a new set of equations more in accordance with conditions existing in an actual bearing."

Such tests confirm to the practicing engineer the correctness of the hydrodynamic theory of fluid lubrication. They prove that, given the proper conditions, a bearing will actually "ride on oil," and that the maximum pressure of the oil film is several times the average unit load. They show how the film pressure rises and falls between entry and leaving and how it varies from one extremity of the journal to the other. They even give a measurement of the film thickness at the various points, and they demonstrate the effects of deflections of the journal on pressure distribution. The tests show that fluid film lubrication will reduce the coefficient of friction to values varying between 0.001 and 0.003, depending upon the characteristics of the lubricant.

Is Fluid-Film Lubrication Realized in Present Practice?

The question then arises whether fluid-film lubrication may be realized in ordinary commercial bearings, such as railroad-journal boxes, and what the requirements are. The latter may be summarized as follows:

1—The supply of oil at any speed must be sufficient to maintain an unbroken film of the necessary thickness over the whole load-carrying surface. In view of the extremely small thickness of the film the amount required for this purpose is naturally very slight.[2]

2—The supply of oil at any time must be sufficient to make up for the oil lost by leakage at the two ends of the bearing due to the flow from the maximum pressure zone to the two ends where atmospheric pressure exists. In order to preclude the breaking down of the film at any point the supply must be largely in excess of the requirements. According to Karelitz[3] who has determined the end leakage

* Mr. Willhofft is general manager of the Isothermos Corporation of America, New York.

[1] Oil Film Pressures in a Complete Bearing, by L. J. Bradford and L. J. Grunder, Pennsylvania State College Bulletin, Sept. 8, 1930.

[2] R. O. Boswall, The Theory of Film Lubrication, Longamans, Green & Co., and G. B. Karelitz, Performance of Oil-Ring Bearings. Trans. A.S.M.E. 1930.

[3] Ibid.

in ring-oiled bearings, the oil supply should be, say, twice the oil loss through end leakage.

3—Oil should always be available at the leading edge of the bearing, and over the whole length of it, in sufficient quantity to permit the formation and maintenance of a solid oil wedge. The edges of the bearing are preferably rounded or chamfered to facilitate the forming of the oil wedge when starting.

4—The inside of the bearing in the pressure zone should not have any grooves or holes communicating with atmospheric or low pressure zones since such grooves or holes would interfere with the building up of the pressure in a continuous oil flow.

5—The bearing arc should be long enough to permit the required maximum pressure to be developed in the oil film but not so long as to result in the formation of negative pressure on the down side which would cause air to enter and interrupt the film. According to Boswall it seems that the arc of contact should be limited to about 90 or 100 deg. and "there seems to be no reason why, in certain cases, an arc of contact as low as 60 deg. should not be successfully employed."

6—The rubbing velocity, i.e., the peripheral speed of the journal, must be sufficient to permit the formation of the complete film of adequate thickness, but authorities greatly differ as to the minimum speed at which greasy lubrication changes to fluid lubrication.

7—The load applied must not exceed the load carrying capacity of the oil used.

Limitations of Waste-Packed Journal Boxes

Waste-packed journal boxes cannot meet the second and third conditions because, no matter what the material of the packing, no matter what methods are used to keep the packing saturated with oil and in contact with the journal, the amount of oil deposited on the journal by the packing is less than the minimum required for fluid-film lubrication. Furthermore, normal flow of oil through the packing cannot take place unless the temperature is sufficiently high. The only source of heat available is friction, or in other words enough heat has to be created by friction to make the oil flow which means a bearing temperature well above 100 deg. F.

This process, particularly in cold weather, requires quite a long time. During this period the supply of oil is still more deficient, lubrication depending upon the oil held in the clearance spaces by capillary attraction while the journal is at rest. This supply at best is but scant, sufficient only to form a greasy film adhering to the metal surfaces and apt to break down altogether. Most of the wear of waste-packed bearings undoubtedly takes place during these periods of warming up and, what is far more serious from the economic point of view, furnishes an additional striking argument in favor of positive-flood lubrication. The tonnage rating has to be materially reduced during the cold season as long as waste-packed journal boxes are used.

Many Devices Invented to Overcome Limitations

Not so much the inherent inability of the waste-packed bearing to supply fluid-film lubrication about which little was known, but the fact that its successful operation depends on human skill and watchfulness, and certain failings, which are well known and need not be discussed here, have naturally inspired numerous inventors to develop more positive devices for railway journal lubrication. In the patent literature we find mechanically lubricated journal boxes as early as the middle of the last century. That in spite of its manifest shortcomings and of the activity of the inventors, the waste-packed journal box still is the universal standard in this country, would seem to indicate that the more positive and more efficient methods of lubrication successfully employed in other lines of engineering are not adapted to the severe requirements of railroad practice. The reason is that oil rings, pumps, rollers, chains, gears, disks with wipers and other devices subject to wear introduce a new element of risk and, at best, require frequent inspections and replacements to prevent failure; in other words, they still depend for success on the human element just like the waste packing. Furthermore, the best of mechanical means for supplying the bearing with oil are useless unless at the same time the oil is retained in the journal box so that the latter may be operated over long periods of time without requiring any attention whatsoever. And another requirement: The oil must be retained irrespective of and without dependence upon the dustguard, so that failure of the dustguard will not endanger the oil supply, also because the problem of making a dustguard dust and water tight and, at the same time, durable is rendered more difficult and uncertain when oil is permitted to mix with dust.

[The remaining portion of Mr. Willhofft's paper was devoted to a description of the Isothermos method of lubricating car journals. A description of the device appeared in the Railway Age Daily Edition, June 20, 1928, page 1420D39—Editor.]

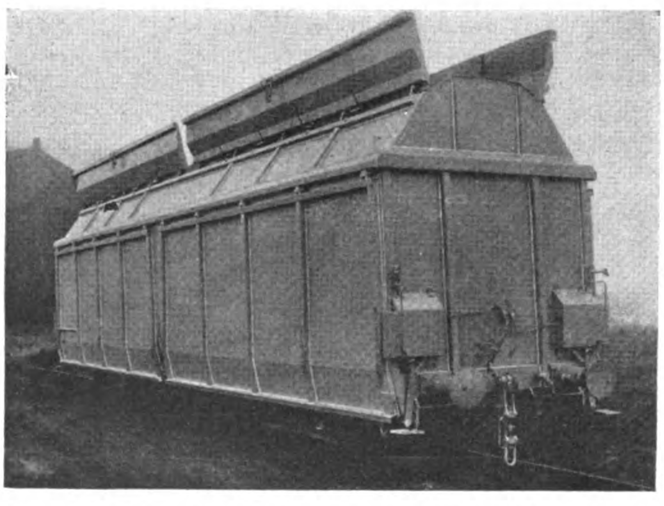
Shopping Union Pacific Locomotives

(Continued from page 409)

Union Pacific System, and a mimeographed statement issued periodically showing the best average time for individual operations at all shop points. In this way, an unusually good performance on any particular job is quickly called to the attention of all system shops and, if due to improved equipment or methods, these can be adapted as generally as practicable.

Experience on the Union Pacific has shown that this system makes work lighter and easier both for the workmen and the supervisors, and desired improvement is effected more often by the use of proper methods and tools, coupled with the elimination of lost time, than by speeding up men and machines. In other words, the entire system is designed to offer an inducement for supervisors and men to use their heads and produce as good an output as possible with a reasonable expenditure of physical effort.

* * *



One of 60 all-welded steel cars recently placed in service on the Netherlands Railways. The car is 50-ft. long and has a capacity of 3,500 cu. ft. By making the car of all-welded construction the designers estimate a saving of 2.2 tons in weight

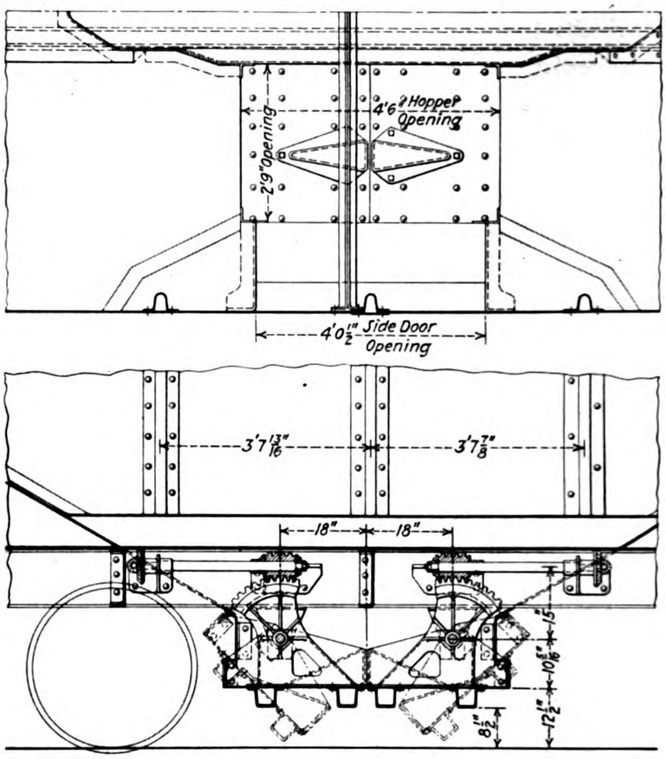
Revenue Hopper Car Can Be Used for Ballast Distribution

A DESIGN of bottom doors and side gates for standard hopper cars which can be opened and closed under load has been brought out and applied to an existing car by the Magor Car Corporation, New York. This door arrangement which can be applied to existing cars or built into new equipment makes these cars available for track ballasting without reducing their adaptability for revenue service. Furthermore, the ability to control completely the opening and closing of the bottom doors and the side gates provides for complete control of the flow of ballast and for its selecting distribution between the ties and beyond either or both ends of the ties. The ability to control the flow of material from the car is also particularly useful in revenue service for unloading coal and certain building materials at the yards of local dealers where it is desirable to regulate the flow to the capacity of mechanical conveying or truck loading equipment without the necessity of completely blocking the track until the car has been completely unloaded.

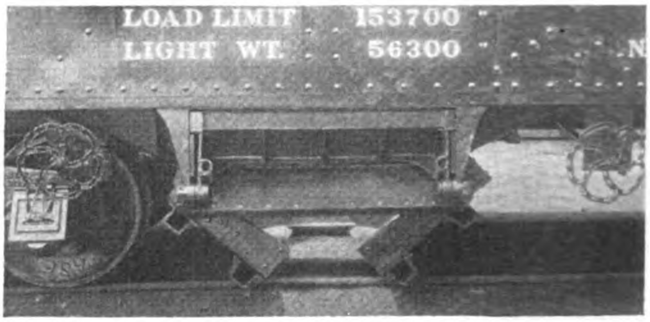
These doors and side gates have no appreciable effect on the volumetric capacity or weight of the cars in the construction of which they are embodied; neither do they restrict the bulk unloading of materials. The cars embodying these features may be diverted from revenue service to maintenance of way service, or vice versa, without the necessity of making any alterations or adjustments.

Essentially, the new design converts the lower part of each of the V-shaped hoppers of a standard car, with its hinged door opening, into a rectangular-shaped hopper with two drop doors, and adds down-cut discharge gates on each side of the car, directly in line with the bottom openings. The rectangular-shaped hoppers of the new design, like the V-shaped hoppers of the standard car, are divided into two units by the center-sill construction of the car.

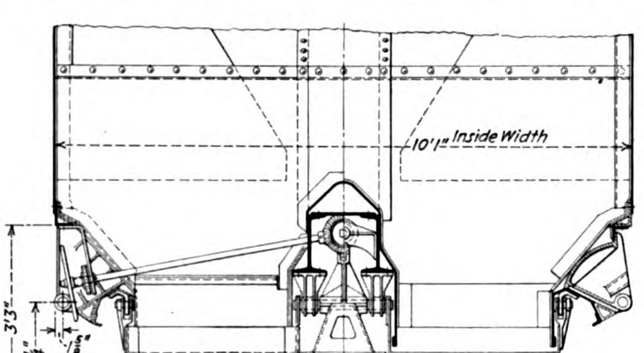
Operation and control of the new bottom doors are effected mechanically through shafting and gears, from the side of the car, and in such manner that the flow of material can be increased or decreased at will during dumping, and actually shut off entirely, if desired. The side gates provide wide and deep openings, the depth of



Sectional elevation and half plan showing the construction of the hopper doors and operating mechanism



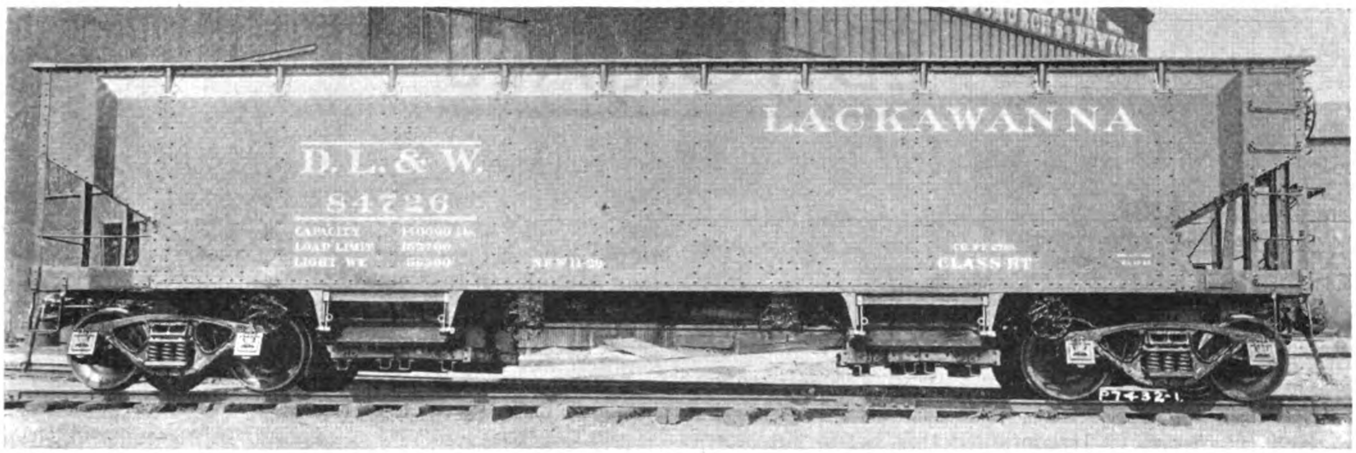
The bottom doors are fully open—The side gate is closed



Cross-section through the hopper showing the down-cut side gate

which can be altered at will by the operator during the flow of material, even to the extent of stopping the discharge entirely. Through these features, ballast can be unloaded on to the track in the exact quantity desired at various points, on one or both shoulders alone as needed, throughout the length of the ties alone, if desired, or over the entire width of the track.

The doors under each main hopper are of heavy steel-plate construction, reinforced on the bottom, and are provided with vertical flanges on the sides and rear to give them a tight seal when closed and to confine the flow of the material laterally when opened. Each of the two doors is mounted on and is keyed to a trunnion, transverse to the car, which brings the doors together in a horizontal plane when closed, and in-



D. L. & W. 70-ton hopper car fitted with Magor bottom doors and side gates suitable for revenue service or ballast distribution

clined downward, away from each other, when they are opened.

Operation of the doors in each case is by means of a hand wheel at the side of the car, which is connected mechanically to the door through shafting, a pair of beveled gears, and, immediately at the door trunnion, through a worm and gear segment. Through this mechanical arrangement, in which all parts are accessible and protected beneath the car, the doors can be opened and closed easily. On the other hand, the loading on the doors and the gear ratio provided in the operating mechanisms are such that the doors hold themselves rigidly when closed, or at any degree of opening, regardless of the load condition. To insure positive locking of the doors during the road haul of material, a ratchet and pawl with a cam pawl keeper is provided directly at each hand wheel. Ease in the operation of shutting off or reducing the flow of material by closing the hopper openings has been affected through pivoting the doors near their transverse center line, wherein the weight of the material tending to force them open is counterbalanced in part by the weight of the material on the opposite side of the trunnion support. Full opening or closure of all of the doors on a two-hopper car can be made in about 1½ min.

From the bottom doors, ballast is spread over a width equal to the length of the ties, but is kept from being deposited directly on the rails by means of deflectors of suitable shape, attached to the upper faces of the doors, directly over the lines of rails. The ballast is distributed quite uniformly on each side of the rail, except directly through the center of the track, where the distribution is considerably lighter owing to the obstruction caused by the center sill of the car. This is offset to some extent by the shape of the deflectors provided to keep the rails clear, which direct the ballast over a wider area between the rails than outside the rails.

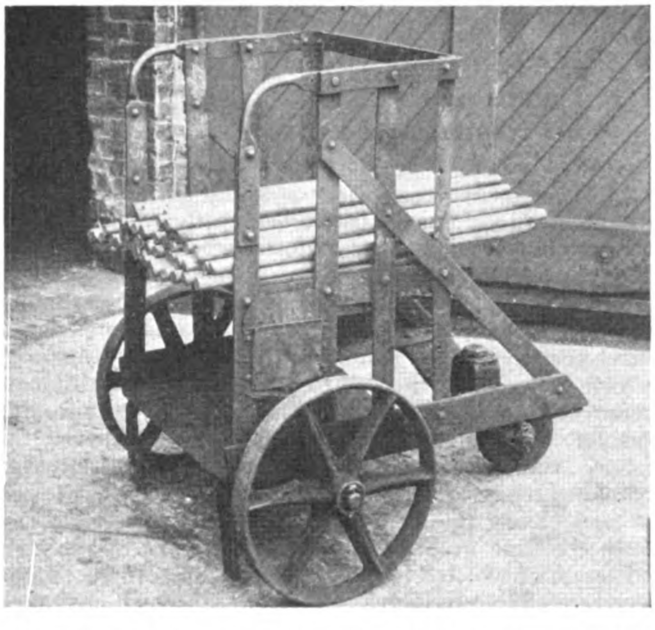
The side gates provided in the new design, which are essentially for unloading ballast on to the track shoulders, consist in each case of a cylindrical cast-steel segment pivoted at each end. These gates, when in normal position, close off openings in the sides of the hoppers, directly alongside the bottom doors. The gate segment itself, which is provided with a tongue and groove on each side to prevent the leakage of fine material, is so mounted that it stays in a closed position, of its own weight, entirely within the side clearance of the car body.

The gate is opened upward and outward, rotating about its end bearings, by means of any suitable bar. The end of the bar is simply inserted in either of two cored sockets provided on the ends of the gate casting, and the bar used as a lever in opening or closing the gate under load. Through the curved face of the gate and the position of the sockets, one man on the bar can open and close the gate readily even when under full load pressure.

Through regulation of the side gates, the ballast is distributed over a width up to 24 in., from the ends of the ties out and thereby replenishes the ballast on the shoulders only.

With the door and gate controls close together directly along the side of the car, one man can distribute the ballast over the width of the track proper and on one shoulder at the same time. Where both shoulders are being ballasted simultaneously, an additional man is required to operate the gate on the opposite side of the car.

* * *



Three-wheel truck designed to save labor in handling bolt material at the C. & N. W. (Chicago) blacksmith shop. The material does not touch the floor from the time it arrives at the shear as bar stock until it passes the forging machine, and bolt threader and is delivered to the storeroom. Note convenient metal order pocket on the side of the truck.

EDITORIALS

A Test And A Challenge

Seneca, the Roman philosopher and tutor to Nero, made the statement in De Providentia that, "Fire is the test of gold; adversity of strong men."

The Omaha Bee-News published an editorial a few months ago under the title, "Business Leaders Emerge in Red Ink Years." It contained this significant statement: "Adaptability to radical changes has become a prime attribute for successful management in this era of mercurial shifts in conditions."

President R. H. Aishton, of the American Railway Association, in addressing the meeting of the Mechanical Division at Chicago in June, appealed to the members to be receptive to new ideas and willing to violate all precedents, if necessary, in helping fit the railroads to meet new conditions successfully. He challenged railroad men to keep their eyes open to new developments which are going on everywhere about them. Past experience, he said, has shown that practically every vital improvement in railroad practice and operation has at first been looked upon with skepticism and distrust.

President Aishton might also have truthfully stated that there is a wide gap between the best and poorest practices on the different railways, and that if all of them were using the best methods, or practices, or equipment adopted by some of them, operating costs would show a marked reduction for the roads as a whole.

Are you among those who look with "skepticism and distrust" upon forward-looking practices which your neighbors have adopted? Open-mindedness, tolerance, keen perception—these are the virtues of strong men who will come safely through fire and adversity!

A Favorable Maintenance Factor

With equipment maintenance severely curtailed because of the small volume of traffic being offered to the railroads, many freight cars requiring body repairs have been returned to service after receiving much less extensive repairs than would be considered economical under normal conditions. In the effort to keep down expenditures for payroll and material, the minimum of material which will restore the car to a serviceable condition is removed and replaced. In the long run, however, this results in the necessity for a larger expenditure for labor, as the frequent recurrence of the necessity for patching tends to increase the hours of labor required to remove and replace a given amount of material.

In the case of box cars and other cars in the construction of which a large amount of lumber is used, the sharp reduction in the price of material which has taken place during the past two years suggests the advisability of a less restricted expenditure with respect to material, in order that cars may be returned to service for a longer period by a more extensive replacement of material when they are brought into the shops and repair tracks for repairs. Reductions in prices amounting to 40 per cent in the two years has, in some instances, already led to a complete renewal of siding, lining, decking, etc., on cars which, under the higher lumber prices, would have been turned out after receiving the necessary patching to restore them to immediately serviceable condition. If full advantage is taken of this favorable factor a considerable amount of troublesome deferred maintenance may be avoided.

Too Much Technical Literature?

Under the caption "The Flood of Technical Literature," the June, 1931, issue of the Engineering Experiment Station News, which is published monthly by the Engineering Experiment Station of the Ohio State University, points out editorially that there is the feeling among engineers and other scientists that relief is needed from the flood of technical literature on every conceivable subject. Abstracts and bibliographies, the editorial states, are of some help as short cuts, but they are so numerous that abstracts of the abstracts are almost necessary.

There is considerable truth in many of the observations contained in the editorial. The main cause of the difficulty appears to be, it states, not that too many subjects are covered, but that too many people are writing about the same subjects. The editorial criticizes the quality of much of our technical literature, but qualifies its statements by saying that, contrary to the popular belief, engineers are pretty good writers when they report their own work faithfully. About ninety out of every hundred articles on a subject, it says, are just repeat material already published and rehash the conclusions of the other ten.

The editorial concludes with the following statement: "The recent experiment of having only summaries of the papers of a technical meeting presented by official summarizers, giving a more unified picture of the meeting and more opportunity for discussion, looks like a step in the right direction. Perhaps a similar summarizing of the publications in certain fields would help men who have about abandoned the struggle to keep up in their technical reading. Something must be done, and speedily, to afford relief from the flood of technical literature."

The expression of such sentiments, especially in the official publication of an engineering experiment station operated in conjunction with a state university, is indeed a pleasant surprise. Engineering experiment stations can do a lot to relieve the flood of technical literature. Engineering societies can also be of considerable assistance and, fortunately, some of them are beginning to recognize the problem and take suitable steps toward a solution.

However, the solution of the problem is not to be had by placing a muzzle on the engineer who likes to write. Neither will a censor, even though he be given the powers of a Nero. The problem was solved long ago by the responsible technical and business press by classifying circulation and publishing only material known to be of interest and value to subscribers. Thus the waste of effort, paper and printer's ink so heartily

condemned by the Ohio State Engineering Experiment Station News is overcome, at least from one source.

University experiment stations, technical societies, and federal and state technical bureaus and departments can probably do more than anyone else to curtail the flood by a better selection and arrangement of what they publish and by seeing that technical papers and reports are mailed only to those interested in the subject discussed.

Large Car Shop Defended

As was to be expected, the article by B. C. Richmond in the June *Railway Mechanical Engineer*, questioning the economic justification for the large system car-repair shop, has drawn fire. Most of the comments so far received, while admitting the force of some of Mr. Richmond's arguments, take decided exception to his main conclusion. One experienced car department officer says, "Personally I am in favor of the concentration of car work and believe the past practice of attempting to do a lot of *big things* in a lot of *little places* seriously affects the cost of car maintenance." The italics are ours.

In a somewhat belligerent mood, another correspondent maintains that the author of the article "cannot have previously given serious thought and consideration to the importance of economical methods of repairing freight cars, and the vast part it plays in the operating expense of a railroad, since, in his opening paragraph, he suggests that *now,* in this time of depression, the subject of freight-car repairs is one that is worthy of consideration. Certainly the subject of freight-car repairs is never other than one of vital importance."

The article referred to apparently revolves around the idea that the proper cycle of general or heavy repairs for freight cars is 12 years, with probable intermediate repairs at six-year intervals. It naturally follows, therefore, that a large shop cannot be justified, for the reason that not enough heavy-repair cars were available under this program to keep the shop operating at an economical capacity. It has been demonstrated, however, that a lesser shopping period, probably a four-year program, may not only provide an economical cycle of repairs, but also produce an improved general physical condition of equipment and a consequent reduction in bad-order cars that cannot be obtained with a prolonged period between repairs. On this basis, therefore, sufficient cars, requiring heavy repairs, are available to justify handling the work in large shops on many roads.

Instead of providing additional work for light-repair points, as suggested in the article, many car-department officers feel that efforts should be directed to reducing light repair-track work to a minimum, and the concentration at a number of selected repair points of that work which must be performed periodically such as air-brake cleaning, repacking of boxes, reweighing, and draft-gear inspection and repairs, at which time all other necessary repairs can be performed. It is estimated that a program of this nature will reduce the number of movements of cars to repair tracks from between 35 to 50 per cent, with resultant savings in switching, per diem or car-day loss, and other incidental expenses that are incurred each time a car is moved to a light repair track.

One car man contends that the figures set up by Mr. Richmond showing the relative cost of owning and operating one large shop, as against four smaller shops, do not lend themselves to comparison because he is using an excessive cost for the large shop, and an insufficient amount, by comparison, for each of the smaller shops. Apparently he has given insufficient consideration to the organization and general overhead expenses such as lighting, heating, general supervision, maintenance of buildings, material stock, store-department organization, etc., that is necessary for each individual shop which would be considerably reduced by the concentration of work at one point. It is a well recognized fact that concentration of work, allowing mass-production methods to be used, is conducive to lower unit repair costs.

The development of the most desirable car-maintenance policy is, of course, an economic problem of as much difficulty as importance, and must be solved by each road for itself. The provision of one large shop to handle all heavy-repair cars on a railroad of considerable size, is plainly not justified. Certain types of cars must be repaired in the territory where that class of loading originates or in the vicinity of the natural empty movements of the particular cars, so that no extensive back-haul on empty equipment is involved for repair purposes, and railroad operation hampered to that extent.

Square Valves Needed

There are two reasons why the present is an excellent time to give more attention to the condition of valve gears and the setting of locomotive main steam valves: First, the resulting condition of improved maintenance will guard against failures; and, second, the assurance of proper steam distribution will have a desirable effect in reducing fuel consumption and, hence, railway operating expenses. The first feature is always important and the second especially so at the present time as improper valve setting may entail a waste of fuel, in extreme cases, of nine per cent, or more.

Locomotive main steam valves must be square and properly set to give the desired steam distribution, and many able shop executives maintain that this operation of adjusting the valves cannot be performed with the desired accuracy and satisfactory results unless the locomotive is put on rolls in the backshop, dead centers obtained, and all parts of the valve motion adjusted to give the proper valve travel marks with respect to the port marks in both forward and back motion. But before setting the valves, this careful maintenance program should begin with a critical inspection of all valve-motion parts and checking with the blue prints for standard dimensions. Such fundamental dimensions as the distance between the link-trunnion center (Walschaert gear) and the steam port, link radius and radius-rod length, etc., should be standard and should be the same on both sides of the locomotive, a condition not always found to exist. In the interests of interchangeability and economy in shop manufacture, as well as subsequent economy in handling and reduced locomotive out-of-service time, too much attention can hardly be given to maintaining valve-motion parts to standard blue-print dimensions.

Tests have shown not only that the condition of locomotive valve motion vitally affects fuel consumption

but also that valves may sound reasonably square, and yet provide an improper distribution of steam. Among other disadvantages, this usually results in the draft nozzle being choked to give the desired steaming characteristics, entailing increased back pressure and still further increases in unit fuel consumption and reductions in available tractive force. Moreover, the excessive back pressure puts undue strain on piston rods, crosshead bearings, and connections and is often responsible for cylinder-head and piston-rod packing leaks. Distorted steam distribution also sometimes interferes with the proper lubrication of valves and cylinder walls.

A real opportunity exists for locomotive maintenance officers to effect a substantial saving by giving immediate and constant attention to improved valve conditions, and traveling engineers can, of course, assist by promptly reporting to their respective superiors any locomotives, the performance of which is questionable in this important respect.

Train Detentions on Account of Mechanical Defects

The prevention of freight- and passenger-train detentions, on account of mechanical defects is a problem that has always been with the mechanical department. Doubtless it always will be, for up to the present time there has not been a machine built which is so perfect as not to break down sooner or later. We are still awaiting the Utopia in materials that will not break or wear out in machines.

It is because of that knowledge that we strive for the "irreducible minimum" rather than for perfection. Many of us are too apt to consider the "irreducible minimum" as perfection, instead of striving to reduce the irreducible further.

However, this seems to be the objective of a railroad in the east with respect to train detentions. Its car department is working hard for a "No Passenger-Train-Detention Month." In May, 1931, three passenger-train detentions were charged against the car department. This record was spoiled the following month when eleven detentions were due to mechanical defects.

However, this is what the superintendent of the car department had to say to his staff: "Our good showing for the previous month has been defeated. But our objective of no detentions is still before you and it can be accomplished."

This road handles considerable passenger traffic, especially during the summer, and also a large amount of freight traffic from and to the eastern seaboard. In May of this year there were a total of 146 freight-train detentions. This was reduced to 123 in June as compared with 101 freight-train detentions for June, 1930. Hot boxes were the direct cause of 92 of the 123 detentions.

The general car inspector and division car foremen have been instructed to clear with the supervisors at all inspection points on the system and to see that the car inspectors are checked and properly instructed. Cars which are properly inspected at points of origin and all defects corrected should arrive at destination and not cause detentions.

The remedy is obvious to all car-department officers. But sometimes because the remedy is so simple we forget to use it. Strict adherence to the fundamentals of good railroad maintenance, one of which is through inspection, gets trains over the road.

NEW BOOKS

THE DEVELOPMENT OF THE LOCOMOTIVE—TWO VOLUMES. *By Dr. Ing. e.h. R. von Helmholtz and Ministerialrat A. D. W. Staby. Bound in stiff board covers, 8½ in. by 12½ in. Volume I contains 38 drawings, Volume II, 446 pages, illustrated. Published by Verlag von R. Oldenbourg, Munchen and Berlin, Germany*

These two volumes which were compiled under the supervision of the Association of German Railroad Managements to which the railroad managements of Austria. Hungary, Holland and Switzerland belong, are written in German. They contain a comprehensive history of the development of locomotives in the above named countries from 1835 to 1880. The two volumes also contain a large number of illustrations showing the early locomotives built in England, and undertakes to show how the locomotive industry on the continent gradually broke away from the English influence and followed an independent development. The two volumes contain 706 illustrations of various designs and types of locomotives.

LOCOMOTIVES OF THE L.M.S., PAST AND PRESENT. *Published by the Locomotive Publishing Company, Ltd., 3 Amen Corner, London, E. C. 4, England. 52 pages, paper bound. Illustrated. Price $1.*

A broad outline of the development of the locomotives of the London, Midland & Scottish Railway during a period of one hundred years is given in this book. Each of the main constituent companies of the L.M.S.—the former London & North Western; Midland; Lancashire & Yorkshire, North Staffordshire, Furness, Caledonian, Glasgow & South Western and Highland systems and subsidiary companies—is reviewed separately, a few facts of interest regarding the origin and evolution of these companies being given. Numerous illustrations, some of which are in color, show locomotives of outstanding British design which have been placed in service on the L.M.S. since the formal opening of the Liverpool & Manchester Railway in 1830.

PROCEEDINGS OF THE INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION. *Compiled and published by Wm. Hall, secretary, Winona, Minn. 220 pages, 6 in. by 9 in. Bound in black leather.*

A bit of early history of the International Railway General Foremen's Association as presented by E. C. Cook, managing editor of the Railway Journal, before the convention of the association held at Chicago, September 16, 17, 18 and 19, is contained in the proceedings for this meeting which marked the silver anniversary of the founding of the association. The topics discussed were Engine Truck Maintenance and Lubrication; Cost of Material Delays to Locomotives and Cars; Stabilization of Mechanical Shop Forces; Inspection Maintenance and Repairs to Gas-Electric Rail Cars; The General Foreman's Contribution to Fuel Economy, and Better Maintenance of Passenger Car Equipment. The addresses were by President H. B. Sunderman (C. & O.); L. Richardson (B. & M.); J. A. Anderson (C. M. St. P. & P.); William D. Saltiel (City Attorney of Chicago); H. C. Stevens (Wabash), and E. Von Bergen (Illinois Central).

THE READER'S PAGE

Chilled Wheels Worn Through

To the Editor:

There has been a good bit of discussion in your magazine of late about worn-through chill wheels and I feel the urge to express a thought too.

Since the A. R. A. rules have set a condemning limit for removing brake beams with worn heads we think we have discovered a good clew to worn-through chill wheels. If we observe that one brake head shows excessive wear while the other head on the same beam shows little or no wear, we are reasonably sure that we are on the trail of a chill-worn wheel. We think this defect plays a big part in increasing brake-rigging failures, and believe it a good plan to examine closely all cars that have a brake-rigging failure to see that worn-through chill wheels are not the cause.

Jas. McDermon.

What Hot Boxes Mean to a Railroad

To the Editor:

Much discussion has taken place during the past few years regarding hot boxes. In the April, 1931, issue of the *Railway Mechanical Engineer,* a chief car inspector condemns, as he calls it, the wholesale waste of free oil. One man reports that on his railroad cars are oiled as they pass over the hump. I have heard hot-box experts preach on, "How to Stop Hot Boxes," and proclaim, "If oilers can't stop hot boxes, get men who can." In hiring new men you are encouraging more hot boxes.

For about one year, I personally inspected practically all the boxes on trains which were giving much trouble on account of hot boxes. My best plan has been to organize the oiler forces and to know that each man is willing to do the best he can as instructed. When going along the train, the inspectors make sure that each bearing is in good condition and that the journal is properly lubricated. If found to be dry, the packing is raised to the proper height with the iron according to Rule 66. If the journal and waste are found to be dry, a small amount of free oil is necessary. This oil should be applied on the feeding side of the journal.

I have kept notes of heavy loads such as stone, oil and machinery, and of cars having new brasses, and new wheels to determine just what cars were causing trouble. During a two-month's hot-box epidemic in 1930, about 500 boxes were jacked in train yards on account of waste grabs caused by cars being switched over the hump. In every instance the waste grab was removed by cleaning the journal and bearing and then re-applying the same bearing if no other mechanical defects were found. Only one out of the 500 on which notations were made developed a hot box.

Some months were consumed after Rule 66 was adopted in getting cars so that the packing was at the proper height. When trains move week after week without a hot box, it might be the wiser plan to praise the oilers rather than to criticize them for wasting a little free oil on cars when passing over the hump. The men in the train yards like to see trains move on schedule with as little mechanical delays as possible. They know as well as anyone else that the speedy movement of trains means revenue to the railroad.

J. W. McClellan.

"Mallet" Locomotives and Speed—Some Criticisms

To the Editor:

In the chart on page 230 of the May issue there is a reference to "simple Mallet" locomotives. On page 231 the same engines are described as the "heaviest Mallet" locomotives. In view of the sentiments expressed by you some time ago, why not be consistent and refer to these as "single-expansion articulated" locomotives?

On page 240 you have repeated the erroneous claim that the Great Western locomotive, "City of Truro," was "the first form of locomotion" to pass the 100-m.p.h. mark. This claim is based on a stop-watch timing of a quarter mile in 8.8 sec. on May 9, 1904. Much higher speeds were repeatedly sustained over considerably greater distances by the two large electric cars tested on the Prussian military railway between Marienfelde and Zossen in the autumn of 1903. On October 28 of that year the car built by the Allgemeine Elektricitats Gesellschaft reached a velocity of 130½ m.p.h. Though the length of line available for the tests was but little more than 14 miles, necessitating most of the running time being devoted to accelerating and braking, it was found possible on several occasions to run at speeds in excess of 120 m.p.h. for four consecutive miles. These figures were recorded by accurate mechanical means, beyond the shadow of a doubt, and they cannot be approached by any type of reciprocating steam locomotive.

As you probably know, the World Almanac contains a table of fast railway runs over short distances in America, the speeds claimed varying from 102 to 120 m.p.h. It is obvious that most of these runs were not accurately timed and that they are all ignored by Englishmen, as might be expected.

Wm. T. Hoecker.

In Defense of Master Mechanic

To the Editor:

I have read with great interest the original letter of Master Mechanic in the February issue of the *Railway Mechanical Engineer* and the comments on his letter in succeeding issues.

I wonder what type of master mechanic would make a written statement of that kind unless he at some time had an experience with foremen's organizations that had set his mind against them. I think the cause will be found in the statement, "The objectionable feature of personal gain has a place in their meetings," which is made in the fifth paragraph of the letter en-

titled "Master Mechanic Wrong About Foremen's Organizations" which appears on page 246 of the May issue.

Foremen who have personal gain uppermost in their minds are very apt to make indiscreet remarks about the other fellow's business, and it seems as though they like to save it up and shoot it at a meeting or in a crowd in order to make an impression leading to the belief that they are the originators of the idea. In other words they have a disease called "Big I." If the letter "I" were taken out of the dictionary, he would have to learn English all over again.

Now it often happens that something goes wrong in a master mechanic's work. A mistake is made; the master mechanic knows about it, we will say, and is doing all he can to correct it. But before he can do it the "Big I" foreman shoots it at the meeting, to the embarrassment of the master mechanic and his foreman's organization. When he is doing this he should know that he is butting into the master mechanic's business and that he would be disgusted if he were in the master mechanic's position.

Now, Mr. Foreman, we know you are not the "I" type of foreman and we say by all means let's have meetings, but let's stick to such subjects as you mentioned and be good sports and treat Master Mechanic's personal business with him privately and not at meetings. I am betting he will change his opinion of us and be a booster.

TOM DE MOND.

Wanted—A Definition For Progressive and Spot Systems

TO THE EDITOR:

There appears to be considerable confusion as to what is meant by the terms "Progressive System" and "Spot System" of car repairs. Definitions of these two terms do not appear in the "Car Builders' Cyclopedia".

I have always defined the progressive system of car repairs as the system in which the men, tools and materials are moved from car to car on the repair track. The car is not moved from the time it is placed on the repair track until all repairs are made and the car is switched out. All repairs, except possibly painting, are made on one spot in the shop.

The spot system of car repairs, I have always defined as the system in which the cars are moved from spot to spot; for example, stripping is done on spot No. 1, truck repairs on spot No. 2, underframe repairs on spot No. 3, etc.

Am I wrong or am I right? What are the correct definitions of these two terms?

READER.

What About a Slow and Quick Release Valve?

TO THE EDITOR:

"What about a slow and quick release valve coupled to the exhaust port in the triple valve and the release-valve opening in auxiliary reservoir, doing away with retaining valves?" A valve of this type could be set at 60 lb. auxiliary-reservoir pressure to operate it in quick-release position. If the train is descending a grade, the engineman will make the desired reduction, then move the brake valve to running position only, and slow release would take effect until a pressure of 60 lb. had been obtained in the auxiliary reservoir. Quick release could be obtained by building up the auxiliary reservoir pressure quickly.

SUPERVISOR.

An Answer

TO THE EDITOR:

The present type of feed valves placed on modern locomotives are of high capacity. It would be impossible, regardless of the capacity of the feed valve or compressor, to raise the pressure uniformly throughout a long train. Obviously, the auxiliary-reservoir pressure, for this reason, cannot be built up quickly as is the opinion of "Supervisor."

To give the idea of the difference in time of build-up of brake-pipe pressure, the following data was secured by a recent check. The train consisted of 99 cars.

Time of build-up on head end	
40-70 lb.	10 sec.
68-69 lb.	1 min. 55 sec.
69-70 lb.	1 min. 10 sec.
Total time	3 min. 15 sec.
Build-up on rear end	
50-55 lb.	1 min. 25 sec.
55-60 lb.	1 min. 37 sec.
60-65 lb.	1 min. 50 sec.
65-68 lb.	2 min. 07 sec.
Total time	6 min. 59 sec.

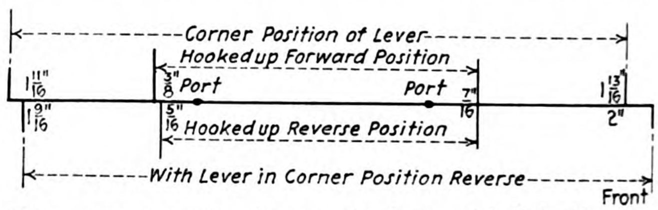
From this information, it is observed that there is a vast difference in the time of build-up of pressure as between the head and rear ends.

AIR-BRAKE SUPERVISOR.

Setting Walschaert Gear—A Question

TO THE EDITOR:

We have an engine with a Walschaert valve gear which shows a valve-stem reading on running over like that shown in the sketch. Both sides show the same

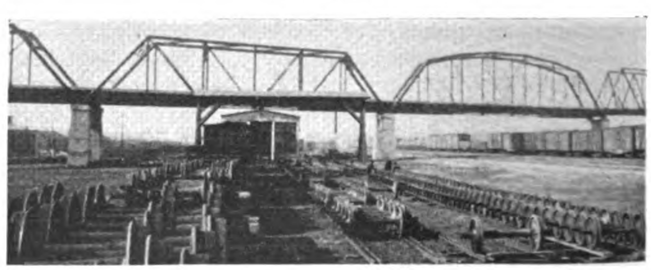


Valve was squared with reverse lever and link block on center—What change is required to square the valve?

port dimensions. The valve was squared with the reverse lever and the link block in the center position. Where would the change be and what changes in the gear are necessary to square the valve?

ARTHUR E. MYLIN.

* * *



Modern car wheel shop and wheel storage tracks on the St. Louis-San Francisco at Yale, Tenn.

With the

Car Foremen and Inspectors

Handling Wheels and Axles on the C. & A.

*By H. C. Myrick **

AT the time the wheel and axle shops of the Chicago & Alton, Bloomington, Ill., were laid out, considerable study was given to the placing of machines and material where each would operate as a unit, and follow through the different operations with the least handling possible, from the receiving of the wheels and axles from the foundries to the shipping of the finished product. With this idea in mind, the first thought was the rolling of wheels and the danger connected with it. A 3-in. concrete floor was laid, and on top of this were laid 3 in. by 4 in. by 6 in. creosoted blocks. This floor has proved satisfactory, both in maintenance and ease when rolling wheels. The blocks are easily replaced when they wear out. All the blocks are cut in the planing mill, and thus a supply is easily maintained.

The building is heated with steam taken from the exhaust of the steam hammers in the blacksmith shop, adjacent to the wheel and axle shop. Radiators are placed along the north and west walls, which have the most exposure, and the building, which is 57 ft. by 177 ft. is kept at a comfortable temperature.

* Mr. Myrick is air brake foreman of the Chicago & Alton, Bloomington, Ill.

The micrometer system is used in the boring of wheels to axles. All new axles are turned to standard A.R.A. gage. All steel wheels are dismounted and remated if ¼-in. or more must be turned off the tread to restore a full flange.

All the wheels and axles for the entire C. & A. system are worked in this shop, and are loaded on wheel cars built especially for this class of material. A list

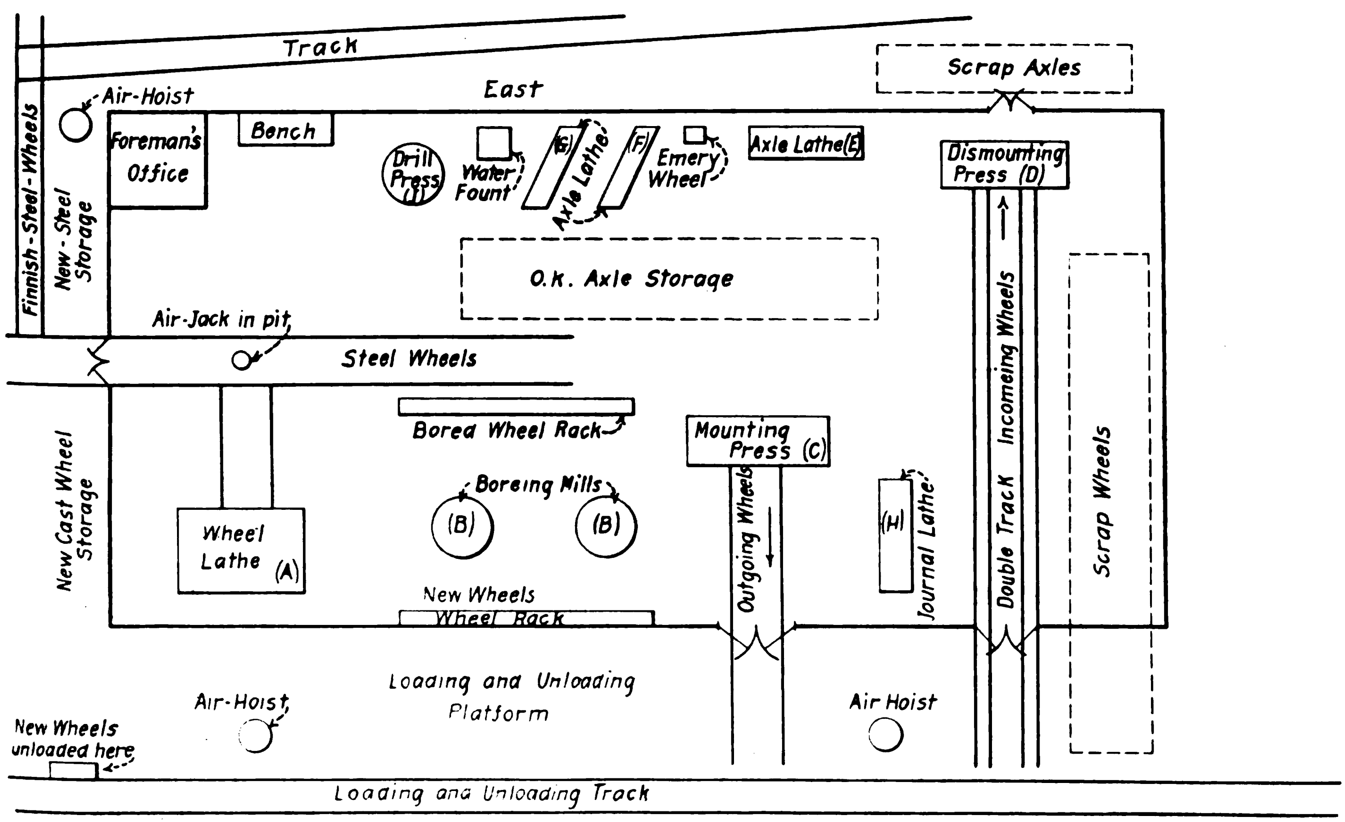
List of Machine Tools Used in the Wheel and Axle Shop of the Chicago & Alton, Bloomington, Ill.

Ref.	No.	Size	Tool
A	1	42 in.	Niles Wheel lathe
B	2	42 in.	Niles Single-bar boring mills
C	1	300 ton	Niles Single-ram mounting press
D	1	400 ton	Niles Double-ram dismounting press
E	1	12 in.	Niles Double-end axle lathe
F	1	10 in.	Niles Double-end axle lathe
G	1	16 in.	Niles Single-end lathe for engine truck axles
H	1	36 in.	Niles Single-end lathe for truing journals on mounted wheels
I	1	36 in.	Niles Emery wheel
J	1	4 ft.	Niles Radial drill press

of the tools and equipment with reference to their location in the shop is shown in the table.

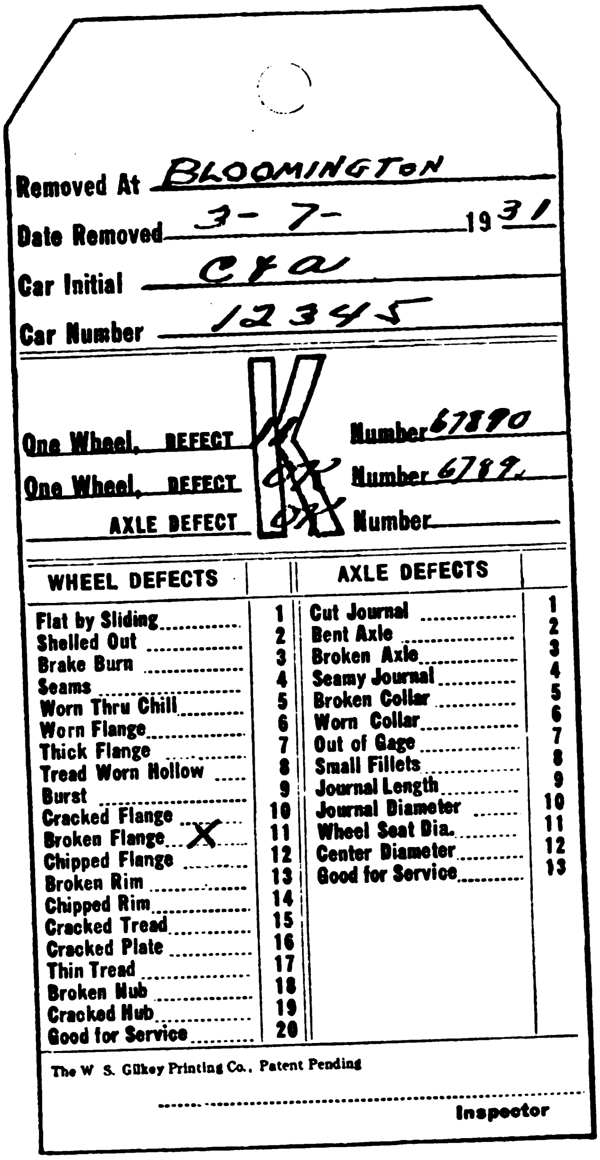
Form K cards are attached to all wheels. This card is filled out at the car at the time the wheels are removed and all necessary information, such as wheel numbers, defects and dimensions of the axle, are applied in code, and then secured with wire to the axle by the inspector removing the wheels.

When the wheels arrive at the shop, they are unloaded on one of the two tracks which lead directly to



Machine-tool and equipment layout of the wheel and axle shop of the Chicago & Alton at Bloomington, Ill.

the dismounting press, where they are inspected, and the Form K card is checked against the defects marked. If the defects are not found to be as the card indicates, corrections are made, and the card is signed by an inspector, who in turn notifies the foreman in charge, who also makes an inspection. The corrected form is then sent to the A.R.A. office, which sends a corrected form to the station where the wheels were removed.



Removed At BLOOMINGTON

Date Removed 3- 7- 1931

Car Initial C & A

Car Number 12345

One Wheel, DEFECT K Number 67890

One Wheel, DEFECT OK Number 6789

AXLE DEFECT OK Number

WHEEL DEFECTS		AXLE DEFECTS	
Flat by Sliding	1	Cut Journal	1
Shelled Out	2	Bent Axle	2
Brake Burn	3	Broken Axle	3
Seams	4	Seamy Journal	4
Worn Thru Chill	5	Broken Collar	5
Worn Flange	6	Worn Collar	6
Thick Flange	7	Out of Gage	7
Tread Worn Hollow	8	Small Fillets	8
Burst	9	Journal Length	9
Cracked Flange	10	Journal Diameter	10
Broken Flange X	11	Wheel Seat Dia.	11
Chipped Flange	12	Center Diameter	12
Broken Rim	13	Good for Service	13
Chipped Rim	14		
Cracked Tread	15		
Cracked Plate	16		
Thin Tread	17		
Broken Hub	18		
Cracked Hub	19		
Good for Service	20		

The W. S. Gilkey Printing Co., Patent Pending

Inspector

Form K defect tag

This form is attached to the original record and sent to the car owner.

During the five years that this system has been in effect, it has accomplished accurate inspection at originating points and a large saving of material has been made.

A record is kept in the A.R.A. office of credits and debits on corrections made at the wheel shop on cards from each repair track. A report is rendered at the end of each month, showing the amount of money involved in these corrections. These reports are sent to the superintendent of motive power, the master car builder, comptroller's office, and all repair-track foremen for their information. All concerned can readily see that it is to their interest that a thorough inspection be made on all wheels and axles before final disposition.

Questions and Answers For Air Brake Foremen

FOLLOWING is the second group of questions and answers selected from the instruction pamphlet recently revised by an eastern road:

Q.—What may cause leakage from the exhaust of a straight-air brake valve with brakes released? A.—Defective application valve.

Q.—What may cause leakage from the service-exhaust port of all automatic brake valves in running position? A.—A defective equalizing-discharge valve or dirt or scale on its seat, also middle gaskets leaking on the K-12 brake valve.

Q.—What may cause leakage from the exhaust port of a quick-action triple valve? A.—A defective triple valve, slide valve stuck, closed, or defective obstruction in feed-valve or triple-valve gaskets.

Q.—What may cause leakage at the brake-cylinder exhaust of a distributing valve with the brakes released? A.—A defective application valve, equalizing-cylinder-cap gasket, distributing-valve gasket or emergency-slide valve when a quick-action cylinder cap is used.

Q.—What may cause leakage at the exhaust port of a brake-pipe vent valve? A.—Defective emergency slide valve, lower gasket or rubber seat of the vent valve.

Q.—What may cause brakes to fail to release following a service, independent, or straight-air brake application with the automatic brake valve in running position? A.—Feed valve stuck, closed, or defective; obstruction in feed-valve pipe or bracket, or in the distributing-valve release or application-cylinder pipe; defective equalizing or application portion of the distributing-valve; brake-cylinder exhaust obstructed or defective triple valve.

Q.—What may cause the brakes to remain applied when the brake-cylinder pressure is exhausted? A.—It may be caused by foundation brake gear members fouling or binding or by a weak or broken brake-cylinder release spring.

Q.—How will a sluggish feed valve and brake-pipe leakage combined effect a release of the brakes, after an independent or straight-air brake application when the independent brake valve or straight-air brake valve is placed in release position? A.—Brakes may fail to release.

Q.—Will the defect in the preceding question effect a release of the brakes with No. 5 E. T. Equipment? Why? A.—No, because the release of the brakes is effected through the application-cylinder pipe.

Q.—What should be noted when a 5-lb. service reduction in holding position and the independent brake valve in running position? A.—That brakes do not release except when the holding feature is not maintained.

Q.—How is the holding feature eliminated? A.—On steam engines by elimination of the U pipe. On electric engines by milling the brake valve rotary.

Q.—What should be noted when a 5-lb service reduction of equalizing-reservoir pressure is made? A.—That the equalizing piston lifts promptly, that brake-pipe air is discharged through the standard exhaust fitting and that the brakes apply.

Q.—What should result when the brake valve is placed in lap position after reducing the equalizing-reservoir pressure five pounds? A.—Discharge of air from the service exhaust should cease promptly and there should be no leakage.

Q.—What should be noted on locomotives equipped with the General Railway Signal Company's automatic stop and reduction-limiting feature? A.—That air is discharged from the exhaust port at the left side of the actuator from the reduction-limiting reservoir.

Q.—What should be noted with respect to increase or decrease of equalizing-reservoir pressure with the automatic brake valve in lap position? A.—That equalizing-reservoir pressure does not increase or decrease.

Q.—With the brake valve in lap position what should be noted with the respect to main-reservoir and brake-cylinder pressure? A.—That the brakes do not release and that the standard maximum main-reservoir pressure is secured on the locomotive.

Q.—Following a service application what should be noted when the independent brake valve is placed in release position? A.—That the warning port blows and brakes release.

Q.—What may cause failure of the equalizing piston to lift promptly when the equalizing-reservoir pressure is reduced five pounds, with the brake valve in service position? A.—(1) Restricted preliminary-exhaust port. (2) Defective automatic-brake-valve middle gasket of six-position brake valve. (3) Lower gasket of five-position brake valve. (4) Equalizing piston or ring leaking. (5) too tight.

(6) Excessive brake-pipe leakage. (7) Broken spring of collapsible-type equalizing piston. (8) A worn automatic-brake valve rotary keyway. (9). Worn handle. (10) Worn post.

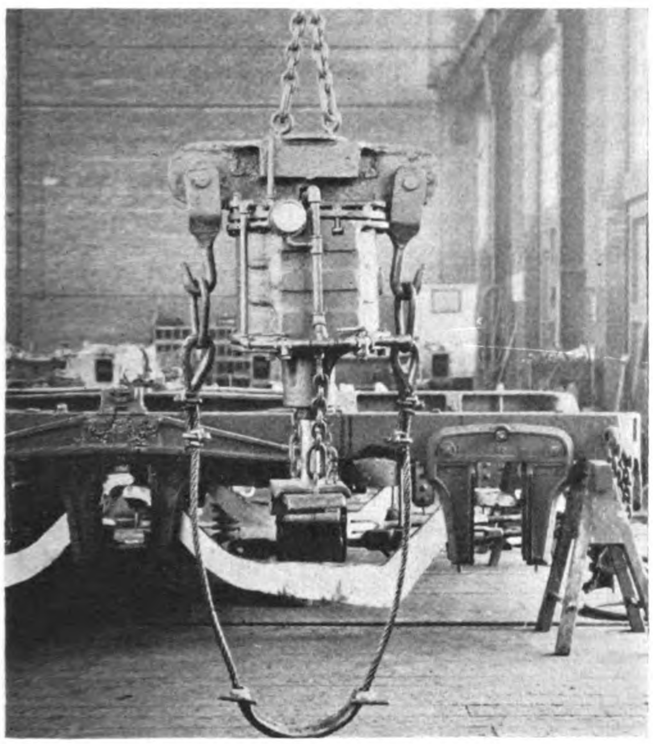
Q.—What may cause failure to discharge air at the service exhaust port of an automatic brake valve in service position when the equalizing-reservoir pressure is reduced 5 lb. at service rate? A.—It may be due to an obstruction in the service exhaust or fitting and a worn cam or worn brake-pipe exhaust-valve stem or missing steel tip K-12 brake valves.

Q.—What may cause leakage from the service exhaust with the automatic brake valve in lap position? A.—Usually indicates a leak from the equalizing reservoir or its related piping or the tube in the gage, a defective equalizing discharge valve or scale in the seat.

Q.—Name some causes of an over-charged brake pipe which may prevent the equalizing piston from raising? A.—Dead-engine fixture cut-out cock open and defective check valve, defective automatic rotary valve or seat.

Elliptic Spring Remover

ONE of the most effective labor-saving devices in the passenger car shops of the Union Pacific at Omaha, Neb., is the device illustrated for removing the elliptic springs from passenger-car trucks.



Labor-saving device for removing and applying truck springs

The device consists of an air cylinder, bolted to a cast-steel yoke suspended from the shop crane, and equipped with suitable hooks, cable, and air-operating valves.

In use the air cylinder is moved by the crane over the truck until the piston and plunger are in line with the center plate, or cross-frame member in the case of six-wheel trucks. The cable is then slung under the spring plank and air pressure applied in the cylinder. As the piston and plunger are held stationary with respect to the floor by bearing on the truck frame, the action has the effect of pushing the cylinder upward which raises the cable and spring plank, permitting the equalizers and spring hangers to be taken down and the truck completely dismantled.

This method has an advantage over the use of the shop crane alone, as there is no danger of lifting the entire truck frame off the horses. In shops unequipped with crane facilities, the device illustrated has the distinct advantage of making it unnecessary to jack up the spring plank or apply clamps to the individual elliptic springs. It results in a substantial saving in man-hours of labor in connection with truck work, and repair work is proportionately expedited.

Car Shop Safety Devices*

By F. B. Lewis †

SEVERAL safe and efficient devices are in use daily for handling of couplers and gears at the Armstrong shops of the Union Pacific, Kansas City, Kan. Virtually no lifting is required on the part of the operator. Hundreds of coupler operations are handled without an injury and without much hazard of one.

Our coupler trucks are so arranged that we can stand a yoke coupler on end, turn the truck up to it, hitch the chain, and tip the truck and coupler back into the wheeling position, then wheel the coupler into place directly under the draft arms. The coupler rides on a revolving jack so it can be turned around on the truck and a few strokes of the jack raises it into place in a few seconds with no danger of it falling off the cradle on the jack head.

Our long tongue truck for heavy draft gears enables us to take the gear from the ground to position in the draft arms without any lifting or danger of dropping.

After the installation of an annealing furnace in the shop, we were confronted with the particularly arduous and dangerous work of handling heavy truck sides and bolsters into the furnace for annealing. It was necessary to stand quite close to the furnace to handle the heavy material. The heat of the furnace with the door open, presented a very discouraging aspect on a hot summer day. Several near accidents occurred.

The ingenuity of the shop was called upon and a traveling furnace charging device actuated by an air cylinder was constructed. permitting one man to handle the work of four without exertion. Best of all, the operator placed himself out of harm's way as he manipulated the device—well away from the heat and the heavy material.

Ingenious Rivet Chute Stops Dizziness

We noticed the tendency of some men to be troubled with slight dizziness, or spots appearing before their eyes, when they are required to perform work calling for continuous stooping over and straightening, especially during hot weather. This was especially annoying to riveters. A chute-like arrangement pivoted to permit moving in a large arc, was devised to overcome this. The heated rivets are thrown into the chute where they are available, with the aid of short tongs, without stooping over. Similar provisions for enhancing safety may be seen in every phase of the steel-car department, and were developed through the ingenuity of the men, to promote the welfare of themselves and others.

We find it desirable to retain the top step on our 8-

* From a paper presented before the A.R.A. Safety Section annual meeting at Chicago in May, 1931.

† Mr. Jones is general car foreman of the Union Pacific at Kansas City, Kan.

ft. and 12-ft. "A" ladders for convenience in using tools, etc., but we do not permit men to stand on the top step for any purpose. All tops are kept painted yellow as a reminder to the employee against the possibility of forgetting for a moment that he must not put his foot there. It is only to brace his leg against, or use as a shelf.

While the general rule to withdraw or turn down nails is enforced in all detail operations, there are frequently cases where the entire side of car, or the roof, have to be ripped off, and the safe and efficient practice is to rip it all off quickly, then pile back till it can be hauled away. Any car foreman knows that this operation as well as some others involves a temporary hazard of stepping on nails. So we instituted the practice of periodic shoe inspection, and forbid a man from continuing at work in thin-soled or badly worn shoes. As a result we have a well-shod bunch of workmen and have had no nail punctures in a long time.

When any heavy parts are to be lifted or handled any place or any time, requiring several men, they have standing instructions to get enough help so that one man—usually the senior man or leading workman—will be free to boss the job, call all moves and watch the footing, etc. This makes for harmony of movement and is an effective safety precaution.

We require that goggles be worn when nailing or pulling nails, or when in close proximity to men so engaged.

The shops and grounds are of course kept free of scrap material. Nothing induces safe operation more than clean shops and repair tracks. Recently a complaint was received from the switch crew who switched car-repair tracks, that they could find nothing in the nature of scrap wood to block the cars. All our regular sawed car blocks had been carefully picked up and put in the tool house. Needless to say, we now provide a keg of small blocks convenient for the switchmen to use when setting our cars at night.

Jacking blocks are provided in sizes of sufficient thickness to insure a proper jack foundation. Small blocks are also supplied to be used under heads of jacks where there would be a metal to metal contact. Short tongs are furnished to each gang for the purpose of handling journal wedges and bearings to eliminate the occasion for placing the hands in the journal box. Longer tongs are used to handle center pins.

Accidents Will Happen

I wish I might say that, as the result of the attention given over to the humanitarian side of our shop and the splendid co-operation that exists, we have never had an injury and will continue to function forever without one.

But the idealist who dreams of a state of perfection is likely to have his dreams shattered if he fails to make allowances for the fallibility of man.

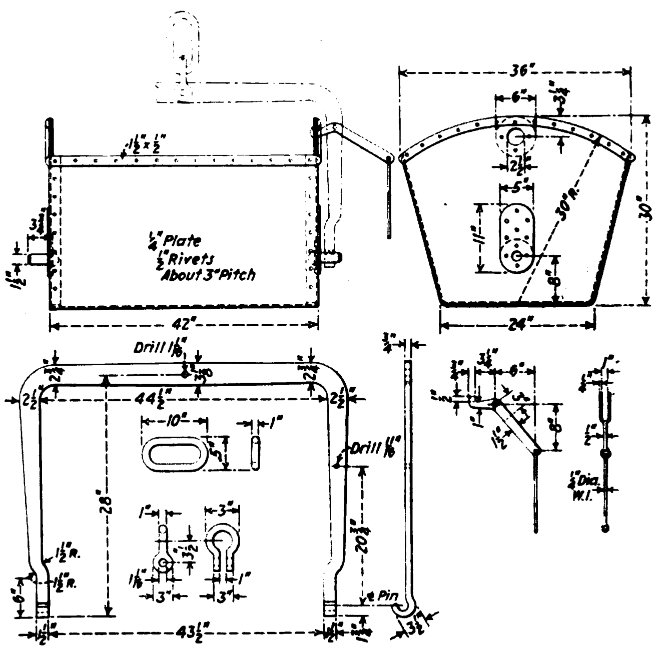
After basking in a supposed state of perfection, without a lost-time injury among 300 men for a period of just under three years, February 13, 1931, found our shop charged with an accident. One of our older employees, who was regarded as a careful worker, long accustomed to the hazards of wood-working machinery, had the misfortune to severely lacerate his forearm on a motor-driven saw. A small socket wrench, not essential to the work at hand, had been misplaced. He and the machine hand helping him decided to waste no further time in an effort to locate it. Just as the machine hand turned to start the saw, the injured man saw the wrench through an opening in the guard, under the saw table. He raised the guard and reached with his hand under the circular saw to grasp the wrench just as the saw started.

Sight of the lost wrench had galvanized him into action, and in his eagerness to recover it, he forgot the saw was to be started. I question who suffered the most from the calamity, the injured man or the 322 shop men whose three-year perfect performance had come to grief.

I would summarize these observations on car-shop and repair-track safety, by saying that safety only reaches mature growth in an atmosphere of honest intention and trained thinking. It is but a dwarf plant if nourished only on artificial safeguards and perfunctory interest; it blossoms in the full light of personal responsibility borne by each man, whether workman or supervisor; its fruit is the happiness shared by every home when the year's record is "clear."

Side-Dump Bucket For Removing Refuse

REMOVING refuse and scrap from around a car yard or shop and doing it efficiently is one of the essentials of good housekeeping. The side-dump bucket shown in the drawing was designed and has been



Side-dump bucket designed for use with crane truck or traveling hoist

used for the past four years by one railroad for just that purpose.

It is of light construction and may be used with a crane truck if desired. The bucket is of ¼-in. plate secured with ½-in. rivets. It can be easily made in the sheet-plate mill. The other parts can be made in the forge shop.

THE ST. LOUIS-SAN FRANCISCO reports that in January, when 4,233,170 passenger train-miles were operated, 97.8 per cent of its passenger trains were on time, while in February, 97.6 per cent were on time. During these months, there was not a single hot box reported on passenger-train cars or locomotives. There were only 81 hot boxes charged to freight equipment in January, and only 61 in February.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Unnecessary To Specify Why Air Brakes Are Inoperative

The air brakes on Baltimore & Ohio car No. 106646 were cleaned by the New York, New Haven & Hartford at Maybrook, N. Y., November 30, 1928, and bill rendered against the B. & O. for cleaning, oiling, testing and stencilling the cylinder and triple valve, cleaning the retaining valve and applying one new 8-in. Kendall packing cup, the charges totaling $5.08. On June 11, 1929, the B. & O. wrote to the New Haven, taking exception to the bill and attached a joint evidence statement dated January 11, 1929, which stated "Air brakes inoperative," contrary to 60-day limit provided by Rule 60. The New Haven declined to honor the B. & O. exception on the ground that it should state definitiely the defective condition which occasioned the subsequent cleaning by the car owner, referring to the third paragraph of the answer in Interpretation 2, Rule 60, as the grounds for its contention that it is mandatory to state definitely the reason which caused the air brakes to become inoperative. The B. & O. referred to the report of the Committee on Prices for Labor and Material in 1918 which recommended the adoption of an average credit price to cover the cost of cleaning and repairing triple valves as "The proposed average charge will eliminate a lot of complicated records." In keeping with this recommendation the B. & O. maintained that it is impossible to furnish information as to the cause of inoperative triple valves at the time and place they are removed and that records for following the valves to repair shops for billing purposes were abolished at the time the above rule was adopted.

The Arbitration Committee decided that "It would be impracticable to follow individual triple valves to test rack to ascertain cause for failure to function. Information that air brakes were 'inoperative' is sufficient in such cases. The contention of the New York, New Haven & Hartford is not sustained."—*Case No. 1666, New York, New Haven & Hartford vs. Baltimore & Ohio.*

Ship-Lap Can Be Substituted for Tongue-and-Groove Material

On June 6, 1929, the Northeast Oklahoma applied 58 pieces of decking and 14 pieces of end lining to Michigan Central car No. 80506. Ship-lap material was used and the decking was gained out for the riveted heads on the underframe with an adz. When the car arrived on Michigan Central rails, August 16, 1929, a joint evidence was taken covering the 1¾-in. ship-lap lining in place of the 1½-in. tongue-and-groove lining, and the ship-lap flooring, not properly framed, laid, or bolted, in place of tongue-and-groove flooring, which the Michigan Central submitted to the Northeast Oklahoma, demanding defect card for labor and material. The Northeast Oklahoma offered to furnish defect card for labor only, but declined responsibility for material. The Michigan Central's demand for a defect card for both labor and material was based on the contention that the shrunk and warped, wrongly bolted and improperly gained lumber which had to be removed because of its shrunken condition to make a grain-tight car was not fit for reapplication partly because of its condition and partly because it was ship-lap, whereas the standard of the Michigan Central is tongue-and-groove lumber for lining and decking. The Northeast Oklahoma maintained that the ship-lap material was A.R.A. standard, that it was properly applied to protect the lading of fine sand-like ore which was loaded in the car following the repairs, but was willing to assume responsibility for excessive moisture content causing the floor boards to spread after they dried out.

The decision of the Arbitration Committee was as follows: "Repairing road is responsible to the car owner for the material as well as the labor used in correcting wrong repairs covered by the joint evidence. In this connection, however, the substitution of A.R.A. standard ship-lap flooring for tongue-and-groove flooring of same thickness, or vice versa, would not be improper repairs if fitted tightly and properly framed and bolted. In gaining floor planks for rivet heads, etc., it is important that this be done in a workmanlike manner so as to avoid unnecessary weakening of planks."—*Case No. 1667—Michigan Central vs. Northeast Oklahoma.*

Confine Bills for Fire Damage to Defect Card Items and Associated Parts

On November 4, 1928, F.G.E. refrigerator car No. 25787 loaded with oranges and grapefruit under refrigeration was delivered by the Clinchfield Railroad to the Chesapeake & Ohio at Elkhorn City, Ky. The joint inspector at that point issued a Clinchfield defect card to cover damages to five roof boards, twelve end sheathing boards, one entire felt lining, two end posts, one end-sill filler, and thirteen inside lining boards damaged by fire. On February 25, 1929, the car was repaired at Sedalia, Mo., by the Missouri Pacific and charges amounting to $284.99 were billed against the Clinchfield. In addition to the specific items of unconcealed damage listed on the defect card, the bill covered considerable material such as blind siding, side sheathing boards, side lining boards, roof boards, side fascia, rack rails, side-ladder, grab-iron and sill-step bolts, etc., as well as insulating materials, paint, varnish and nails applied to the sides of the car between the corner posts and door posts amounting to $176.49 to which the Clinchfield took exception, maintaining that they were not associated with the repairs necessary to restore the parts specifically covered by the defect card. The Clinchfield supported its claim that it was responsible only for unconcealed damage by the facts that the car had been accepted by five different railroads, including the Missouri Pacific itself, between the time the defect card was issued and the time it was finally repaired, that it had no record of how the car was damaged and no record of any damage to the contents of the car as the result of the fire. The Missouri Pacific contended that a considerable number of the contested items could not be considered as concealed, since the Clinchfield included in its defect card one entire felt lining which required renewal from door post to door post, necessitating the removal and replacement of an extraordinary amount of lining and siding. The Clinchfield maintained that it was unnecessary to make such extensive repairs to restore the damaged portion, which was confined between the corner posts at the A end.

The Arbitration Committee rendered the following decision: "While in original construction of car the

inside course of hair felt was applied in one piece from door post to door post and against the outside course of insulation was applied waterproof fabric between door posts, it is, nevertheless, common practice in repairs to splice insulation at corner posts which it is believed can be done in such manner as will not impair insulating value to the car. The bill should, therefore, be confined to the cost of renewal of damaged items covered by defect card and the associated parts necessary to renew in connection therewith on above basis."—*Case No. 1668, Clinchfield vs. Missouri Pacific."*

Damage by Cars Parting and Running Together

Ft. Smith, Subiaco & Rock Island car No. 50 was delivered to the Missouri Pacific at Paris, Ark., on October 27, 1925, empty and offered back to the owner at the same point loaded with coal two days later. It was held up by the owner for transfer on account of a broken body bolster. At the Paris yard, the joint terminal used by both the Subiaco and the Missouri Pacific, while undergoing transfer by the car owner the car, after the load had been partially transferred, was set on another track by a Subiaco crew, ahead of four loaded cars destined for road haul on the Missouri Pacific Lines. During a switching movement by a Missouri Pacific engine and crew incidental to getting these four cars out for train make-up, 12 cars in a cut broke in two on account of a low drawbar on the Subiaco car, the cars subsequently running together and knocking the end out of the car in question. The Missouri Pacific contended that inspection of the car showed both wood and metal sills broken because of decay or corrosion, the metal sills, bolster and broken end sill showing old breaks. It claimed that the car was not subject to any rough handling. The Ft. Smith, Subiaco & Rock Island following this damage elected to dismantle the car, billing the Missouri Pacific for the total depreciation cost to the amount of $975.90, claiming that, although the yard is jointly operated, the fact that the damage was done while the car was being moved by the Missouri Pacific crew establishes that road's responsibility, while the Missouri Pacific maintained that under the joint operating arrangement the fact that the engine and crew of one or the other of these roads was moving the car had no bearing whatever on determining responsibility for damage to it.

In its decision the Arbitration Committee stated that "Car was not damaged under any of the unfair conditions of Rule 32. Car owner is responsible."—*Case No. 1669, Missouri Pacific vs. Ft. Smith, Subiaco & Rock Island.*

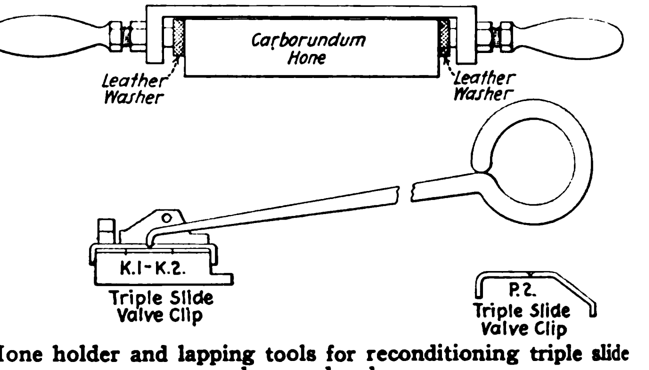
Honing Slide Valves and Seats

THREE clips made of galvanized iron were shown in an article describing a number of tools for repairing triple valves, which was published in the January, 1931, issue of the *Railway Mechanical Engineer,* page 37. Since the publication of that article, several readers have made inquiry as to the purpose of the clips.

They are used for holding Carborundum hones when truing slide valves and slide-valve seats. Honing is gradually becoming a practice in many air-brake repair departments in preference to filing. It permits the reconditioning of slide valves and seats with a minimum loss of metal and eliminates the use of grinding compound for grinding a fit between the slide valve and its seat.

The clips shown at the upper right of the drawing on page 37 of the January issue are used for honing the graduating slide valve of K-type triple valves while the valves are being lapped on their seats.

The clip shown below the two clips referred to in the preceding paragraph is used for honing the slide valves



Hone holder and lapping tools for reconditioning triple slide valves and valves

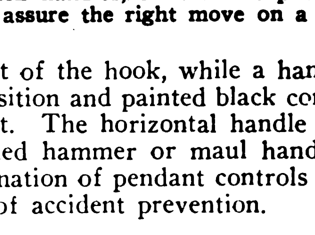
of P-2 type triples. This clip is shown in the lower right of the sketch.

The sketch shows the holder for the carborundum hone. The point of the clip handle is placed in the hole which is made with a center punch as shown in the drawing in the January issue. The dimensions for the handle for the clips are also shown in the drawing showing the clips and other tools.

Designated Controls For Hoists

TO designate the "Up" and "Down" movement of the hook on hoists having the pendant control, special handles were applied to the pendants on all hoists on an eastern railroad.

As shown in the illustration, a file handle, painted red, is attached to the pendant controlling the down-



The red and black handles, in different positions, make it easy to assure the right move on a hoist

ward movement of the hook, while a handle placed in a horizontal position and painted black controls the upward movement. The horizontal handle can be made from a discarded hammer or maul handle. In some states the designation of pendant controls is mandatory in the interest of accident prevention.

DURING MARCH, 1931, the Missouri-Kansas-Texas, for the first time in its history, operated an entire month without an engine failure. The total mileage of all locomotives in service in that month was 930,610.

In the Back Shop and Enginehouse

Florida East Coast locomotive No. 812 equipped with ellipsometer

Setting Valves On The Florida East Coast

By Wm. H. Bohen*

IT is a well-known fact that to secure a high overall efficiency and a low fuel consumption on a locomotive one of the most essential things is a well-designed valve gear. It is also true that this valve gear must be kept in good condition and set properly if our desire for a smooth running and economical engine is to be realized. The good effects of the superheater, the Thermic syphon, the feedwater heater, the exhaust-steam injector, and efficient firebox and front-end arrangement can all be lost by faulty valves. As a small variation from the correct relation of one valve event to another will cause a considerable increase in steam consumption, it is well to have a record of the actual relations when the locomotive is under steam. With such a record available it is possible to determine just what alterations must be made to secure the proper valve event relations with the minimum amount of work.

The "valve ellipse" may be defined as a graph which shows the position of the valve with respect to the piston for all points of the piston stroke. On account of the angularity of the main rod and the design of the valve mechanism, such a graph will not form a true ellipse of the equation

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

It is called an ellipse because in appearance it resembles a true ellipse.

Let us consider the graph diagram shown in Fig. 1. Distances in the y direction give us positions of the valve from the mid-position. Mid-position is represented by the line X-X. Distances in the X direction give positions of the piston from the crank or back end.

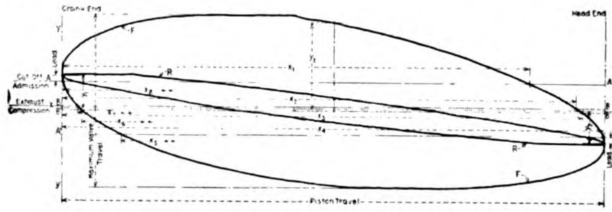


Fig. 1—Valve-ellipse diagram

The line A-A represents the position of the valve for admission and cut-off on the crank end. The line B-B represents the position of the valve for compression and exhaust on the crank end. The lines A'-A' and B'-B' represent corresponding events on the head end.

The graph F is an ellipse at full gear. When the piston is at the crank end, crank on back dead center, the valve is the distance y_1 from mid-position. When the piston moves half of its stroke to mid-position, the valve is the distance y_2 from its mid-position, having moved its maximum distance to the back and begun its movement forward. When the piston is the distance x_1 from the crank end, the valve has moved to the cut-off point and cut-off takes place. Exhaust takes place as the piston has moved the distance x_2 from the crank end. As the engine has exhaust clearance, or negative lap, exhaust will take place before the valve has reached the mid-position.

Further movement of the piston the distance x_3 from

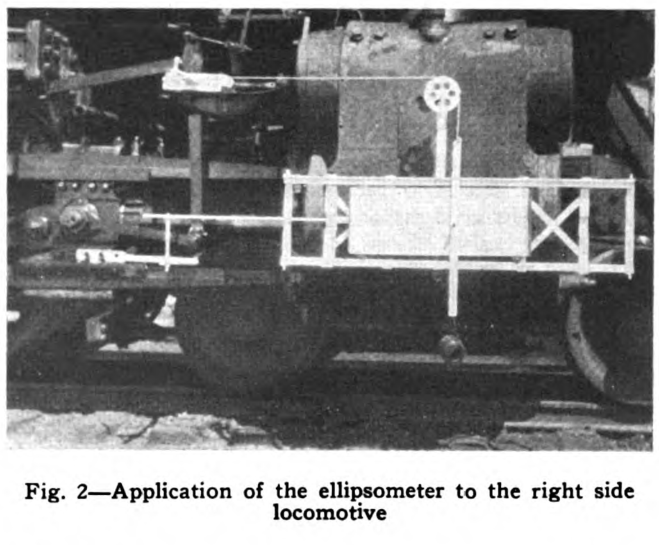


Fig. 2—Application of the ellipsometer to the right side locomotive

* Mr. Bohen, the author of this article, is a mechanical draftsman on the Florida East Coast, St. Augustine, Fla.

the crank end sees the valve cross the mid-position and move forward until the front exhaust ring is line and line with the front exhaust port so that compression begins on the head end of the cylinder. As we find the piston movement the distance x_4 from the crank end, the valve has moved forward until the front admission ring is line and line with the front admission port, the point of admission for the head end. As the piston moves to the front end of the stroke, crank on front dead center, the valve has moved forward from its mid-position the distance y_3.

On the back stroke a piston movement x_5 from the head end will give the cut-off, x_6 exhaust, x_7 crank-end compression, x_8 admission crank end, and the full stroke front to back completes a cycle. The ellipse R for the running cut-off may be followed in the same way. The value of p is found by subtracting the distance between rings from the distance between ports. We see then that the lead on the crank end

$$= y_1 - \frac{p}{2}$$

and the head-end lead

$$= y_3 - \frac{p}{2}$$

As there are any number of positions of the reverse lever, there may be any number of ellipses. The position of the piston for all valve events is readily determined by the graph for as many positions of the reverse lever as there are ellipses.

Most of the locomotive builders and manufacturers of valve gears have small models made of the valve gear to be designed, with adjustable parts which can be

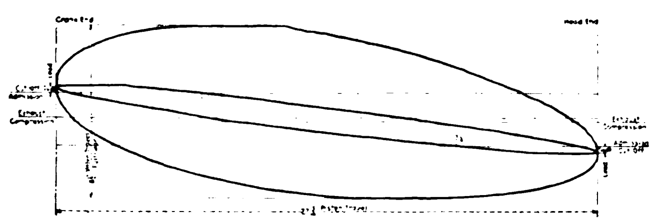


Fig. 3—Left side; forward motion on engine equipped with a Baker valve gear

made to conform to the dimensions of the parts intended to be used on the new locomotive. With this model, a study is made of the valve events. Most models are equipped with an attachment for recording the events. The valve movement is drawn to twice the scale of the piston movement.

The Ellipsometer

A machine for recording valve ellipse diagrams is commonly called an ellipsometer. The ellipsometer designed and built by the Florida East Coast consists of three essential parts: A frame which supports a track, a plane board which moves backward and forward on the track, and a slide bar holding a pencil which moves up and down at right angle to the track. This device records the valve ellipse, developed by the locomotive, on a card to full scale.

The frame supporting a track made of 1¼-in. by 1¼-in. by 3/16-in. T-iron, A, as shown in Fig. 2, is mounted rigidly to the side of the locomotive cylinder by means of plugs, which are applied in place of the cylinder indicator plugs. A white-pine board 12 in. by 33 in. by $\frac{13}{16}$ in., mounted on rollers, moves on the track. The board is attached directly to the crosshead by means of an arm and rod, as shown in Fig. 2, so that the exact movement of the crosshead is transferred to the board. A slide bar, holding a pencil, is mounted midway of the frame and at right angles to the track by means of the guides. The valve crosshead attachment is fastened firmly to the valve crosshead. A $\frac{1}{16}$-in. flexible wire cable is stretched over the sheave and attached to the upper end of the slide bar.

A 20-lb. weight is attached to the lower end of the slide bar to hold the cable taut. The movement of the valve is duplicated by the slide bar. If a piece of drawing paper, cut to the proper size, is secured to the board with thumb tacks, the pencil held in place by the spring in the pencil holder and the locomotive moved one revolution of the drivers, a graph will be drawn, the abscissa representing piston positions, and the ordinates valve positions for all points of the cycle. Such a graph is termed a "valve ellipse."

For the graph to be of value it is necessary to draw the cut-off and exhaust lines for both front and back ends. This is done before the graphs are made. A graph recording device is applied to both sides of the locomotive. The port marks are marked on a chalked surface on the valve crosshead attachment. The valve-port plugs are removed from the steam chest. The pin is removed from the eccentric rod and the valve moved until the cut-off position, determined by a thin feeler inserted through the port observation hole, is reached. The pencil is released for tracing, the bar is lifted from the crosshead arm and the board is moved across the track drawing a cut-off line.

The position of the valve is marked with a tram on the valve-crosshead attachment. The cut-off line for the other end of the cylinder and the two release or exhaust lines are drawn in the same way. The bar is placed back on the crosshead arm anad the port observation plugs replaced.

This procedure is repeated on the other side of the engine and the ellipses are ready for recording. The mid-position of the valve is found by drawing a line parallel to and equidistance from the two cut-off lines, as X-X in Fig. 1. The perpendicular distance between the two cut-off lines should equal the blue-print dimensions for the distance between ports, minus the distance between rings. Likewise between exhaust lines equals over the ports minus over the rings. Errors in the dimensions of the valve spool or the spacing of the valve bushings may be detected by checking these relations.

The "plane-board straight-line-movement" type ellipsometer in use on the Florida East Coast has certain advantages over the conventional "revolving cylinder" type. One of the outstanding advantages is in the fact that the card is on a flat surface, which enables the diagram to be observed during its development. A preliminary study of the condition of the valves can be made without removing the card from the board. This particular type of ellipsometer can readily be used to determine the proper position of the reverse lever for any desired cut-off.

Proper Time To Take Ellipse Diagrams

It is a difficult problem to set valves properly when an engine has just been overhauled on account of the various allowances that must be made. It is almost a practical impossibility to decide just what allowances to make for the expansion of those parts of the valve mechanism which are affected by heat under working conditions. Superheated steam passing through the steam chest will have an effect on the distance between ports. A newly overhauled engine will settle some after it has been in service for a time. In view of these facts it is best to make a final check on the valves after

the engine has been broken in and execute any necessary alterations that may be indicated by the diagram. When an engine is just in from her run and still hot is an ideal time to apply the ellipsometer and record diagrams of its valve events. Approximately an hour's time is required to apply the two recording devices and secure cards on both right and left sides, with two men working on the job. Hostler service is also required for about 10 or 15 minutes to move the engine after everything is in readiness.

Settings Usually Taken

In the case of road engines two ellipses should be taken in forward motion, one of full gear and one of the running cut-off. Fig. 3 represents the final card of the left side of a 4-8-2 type passenger engine after the valves were adjusted.

The engine has 26-in. by 28-in. cylinders, 8½-in. valve travel, and 5/16-in. lead. The card shows that these conditions are fulfilled and the running cut-off within ¼ in. of equalization. Note the card illustrated in Fig. 4. In the "hooked-up" position the cut-off shows a difference of 4 in., 10⅝ in. on the head end and 6⅝ in. on the crank end. There is a lead of 9/32 in. on the head end and ⅛ in. on the crank end. If we should shorten the valve stem 5/32 in., the cut-off would be equalized 8⅞ in. on each end, but the difference in lead would be reversed. It was found in this case that the eccentric crank was set ½ in. less than the required radius.

Fig. 5 is a diagram showing four different positions of the reverse lever, with an accompanying table giving

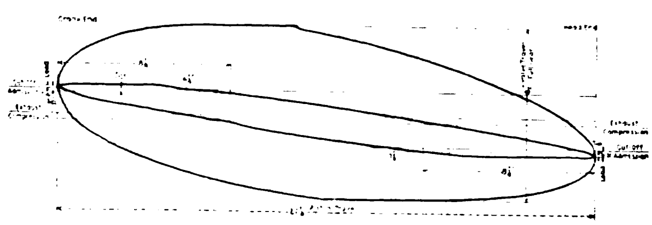


Fig. 4—Card taken on the left side in forward motion; Baker gear

the values of the different valve events. We see that there is a lead of 9/32 in. on the head end and 5/32 in. on the crank end. In the hooked-up position there is a cut-off of 9 in. on the head end and 7⅛ in. on the crank end. If the valve stem were shortened a scant 1/16 in., the cut-off would be equalized 8 1/16 in. on each end and the lead made 7/32 in. for both ends.

Marking the Quadrant

The ellipsometer proves useful in marking the quadrant so that the engineman can move the reverse lever to the required position to secure the desired running cut-off. With the device in place and the cut-off lines drawn on the card, the ellipse of full gear is taken and the engine stopped. This shows the piston stroke on the card. From both ends of the stroke the required distance, previously figured, to give the desired cut-off is measured and marked on the cut-off line. The locomotive is again put in motion and the pencil allowed to trace the valve movement on the card. The reverse lever is hopped-up until the pencil crosses the cut-off lines at the points marked for the desired cut-off. This position of the reverse lever is correct to secure the desired cut-off and the quadrant is so marked. This method was utilized to advantage in road test work, the quadrant being readily marked for full gear, 75, 50, 33, 25 and 20 per cent cut-off.

Valve Events Recorded with Walschaert Valve Gear Taken on the Right Side in Forward Motion

	Per Cent Cut-Off		Pre-Admission, In.		Release, In.		Compression, In.		Cut-Off, In.	
Ellipse	Head	Crank	Head	Crank	Head	Crank	Head	Crank	Head	Crank
A (Full gear)	89	84	1/16	0	20 9/16	25 9/16	1 1/16	9/16	24½	23⅛
B	73	66	3/16	0	24 5/16	23	2 7/16	1 7/16	20 1/16	18¼
C	32½	27	¼	5/32	18 1/16	16 9/16	6⅞	5 5/16	9	7⅛

Precautions to Avoid Error

A diagram which is not true to actual conditions is far worse than none at all. To avoid getting an erroneous card the operator should be very careful in setting up the recording device. The cable should run parallel

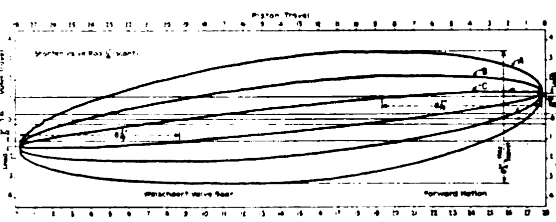


Fig. 5—Valve-ellipse diagram taken on the right side in forward motion; Walschaert valve gear

to the piston rod from the valve crosshead attachment to the sheave and perpendicular to the track from the sheave to the slide bar.

After recording devices are applied to both sides the engine should be hostled up and down a few times to make sure the cable is well stretched. Lost motion between the push bar and the board must be absent. The port marks should not be taken until the operator is satisfied the machines are functioning correctly. Extreme care should be exercised in taking port marks.

When taking ellipses the engine should be allowed to make two or three revolutions before the pencil is lowered to make sure the valve gear has settled down. The engine should be moved at a speed of about five miles an hour when cards are being recorded. It is well to take two cards of each side that one may serve as a check against the other.

Tool for Extracting The Sight-Feed Glass

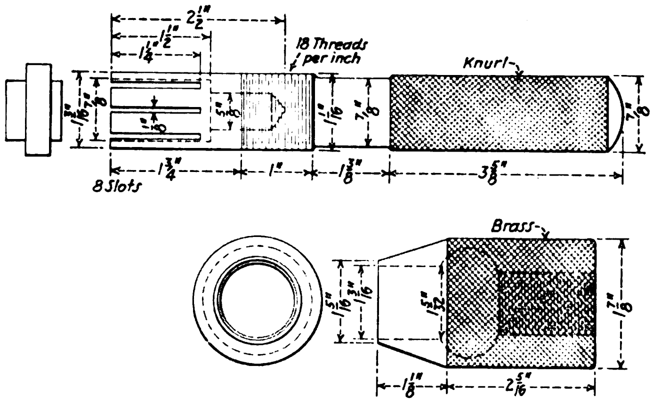
SHOWN in the drawing is a small tool for extracting the sight-feed glass in bullseye locomotive lubricators. Both parts are made of brass with knurled handles. The part of the tool shown at the top of the drawing is drilled ⅞ in. to a depth of 1½ in. and ⅝ in. to an additional depth of 1 in. Eight ⅛-in. slots are cut in the drilled end to a depth of 1¼ in. It is threaded 1-1/16 in. for a distance of 1 in.

The part of the tool shown at the bottom of the drawing is tapped for 1-1/16-in. thread and is screwed on the part shown at the top.

To remove the sight-feed glass or bullseye the fol-

lower or sight-feed-glass rack ring and brass washer are removed. The gasket around the bullseye is then removed and the assembled tool is inserted in the opening.

The prongs formed by the eight slots cut in the end



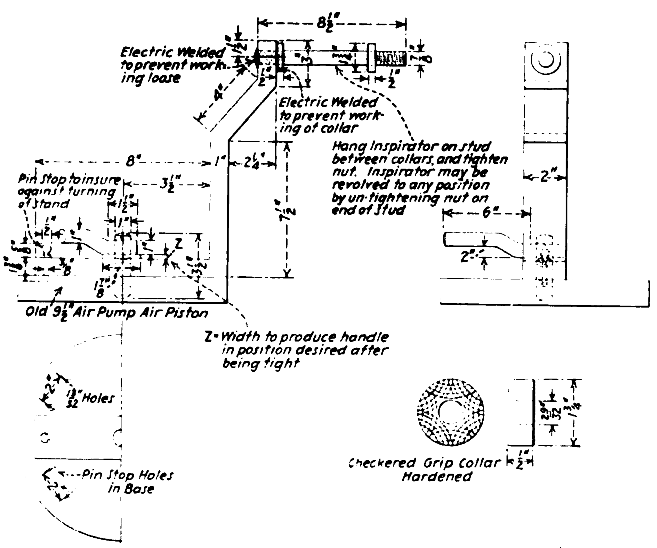
Small tool for extracting lubricator bullseyes

of the tool engage the small end of the glass. A tight grip of the prongs on the glass is secured by screwing the outer portion of the tool toward the prongs. The glass is gripped sufficiently tight to permit its easy extraction by the mechanic.

Revolving Inspirator and Injector Repair Stand

By E. G. Jones

In quite a few shops the present method of holding an inspirator or injector while repairing is in a bench vise. Often times the body of an injector is crushed by the vise being too tight. In applying the tubes, nozzles and grinding valves, the vise must be released and the injector moved to many different positions, which consumes time.



Revolving stand for repairing inspirators and injectors

By using the work stand shown in the drawing, there is no possible chance to damage the body of the injector and any desired position may be easily obtained by revolving the stand and the injector body.

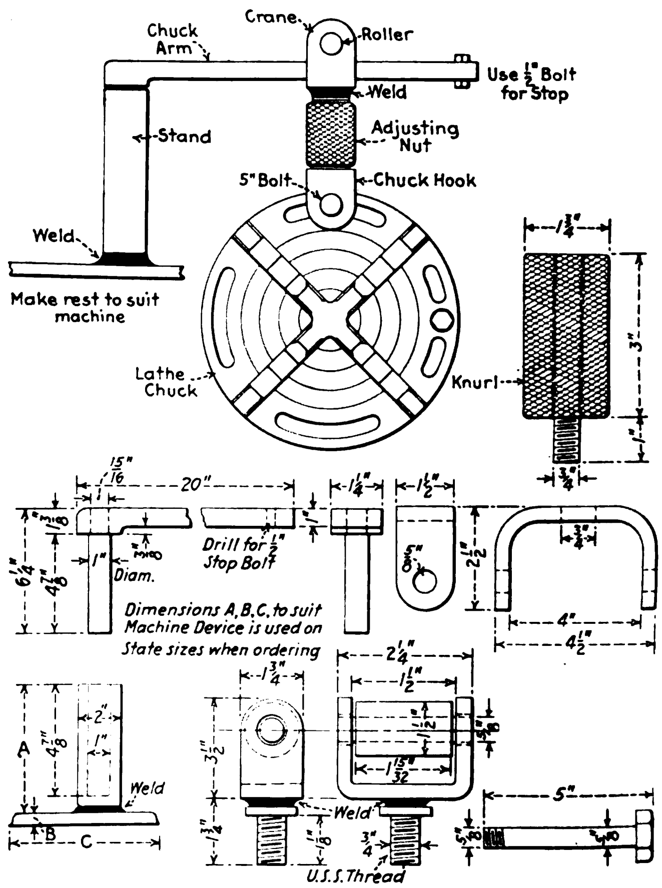
This work stand is made of a scrap 9½-in. air piston as a base and tapped for the pivot stud. Small holes are drilled in the base which are used as pin stops to insure against turning. The pivot-stud clamp nut has a handle welded to it which eliminates the use of a wrench when it is clamped or unclamped. The stand column is made of 1-in. by 2-in. flat iron, bent, tapped and drilled as shown. The horizontal or hanging stud is screwed into the column and welded on the back to prevent it from working out. Two checkered and hardened grip collars are applied to the hanging stud to prevent the injector from turning while being repaired.

By means of this repair stand the injector can be revolved to any desired position without loss of time.

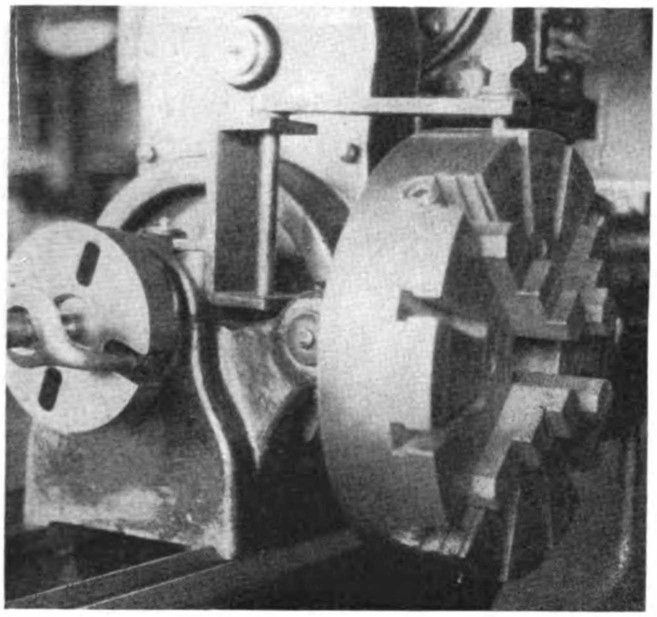
A Swinging Support For Heavy Chucks

In places where a variety of work must be done on a single lathe, usually requiring a small and large chuck alternately, means for applying the larger chuck is a great convenience. In the illustration and drawing are shown two methods adopting the same principle whereby a swinging arm fastened to the headstock of the lathe supports the heavy chuck. This arrangement greatly facilitates the handling of the chuck and eliminates the need for extra help or the use of a crane.

The swinging support shown in the illustration is located in the electrical shops of the Louisville & Nashville, at Louisville, Ky. It is made of brackets bolted directly to the lathe and fitted with a vertical shaft and arm from the latter of which the chuck is supported by means of a bolt fitted with a wing nut. The device is arranged with a hollow stand which is welded to the



Another type of swinging support for applying heavy chucks



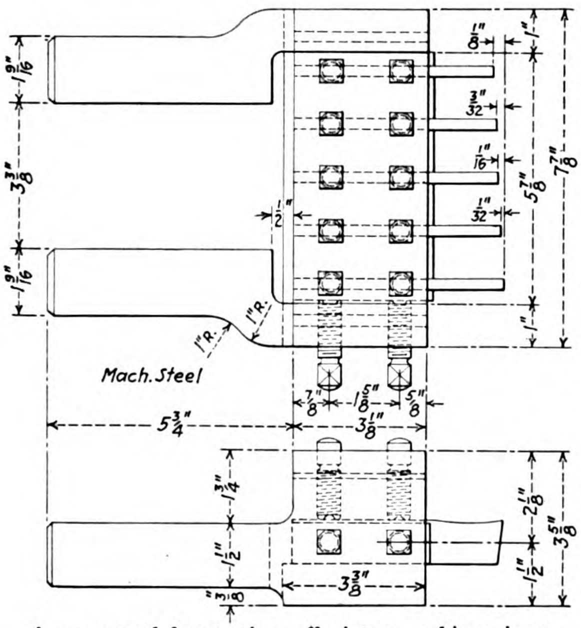
A swinging support provides a convenient means for applying the heavy chuck

headstock of the lathe. The arm which supports the chuck is fitted at one end with a pin 4⅞ in. long turned to a diameter of 1 in. for a snug fit in the stand. The chuck is suspended from this arm by means of a chuck hook which is attached to a pulley by means of an adjusting nut. The pulley permits the chuck to travel the length of the chuck arm, facilitating the placing of the chuck for threading onto the spindle. Vertical adjustment of the chuck can be made by means of the adjusting nut.

Gang Tool for Cutting Piston Packing Rings

THE gang tool shown in the drawing is designed for cutting off piston packing rings. It is comprised of a rectangular shaped body with an extension piece at each end for attaching it to the tool post on the sliding head of the boring mill. Filler blocks are used between the tools so that the distance between the cutting edge is the width of the piston packing rings. The dimensions of the filler blocks will depend on the standard widths of rings used. After the filler blocks and tools are inserted in the body of the holder they are clamped longitudinally by two set screws placed 1⅝ in. apart. The tools are held vertically by ten set screws, two for each cutting tool.

The tool holder is made of machine steel and is 5¾ in. wide, 7-⅞ in. overall in length and 3-⅝ in. high, to the top of the set screws. The usual practice of receding the successive tools is followed, the cutting edge of each tool being set 1/32 in. behind the preceding one.

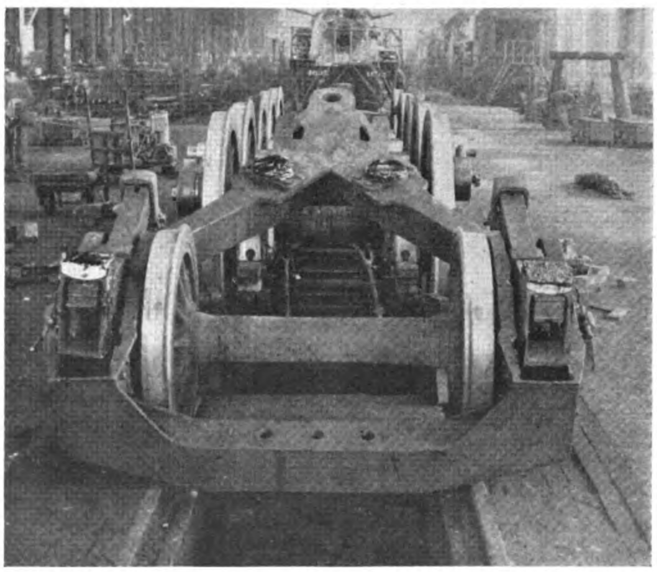


A gang tool for cutting off piston packing rings

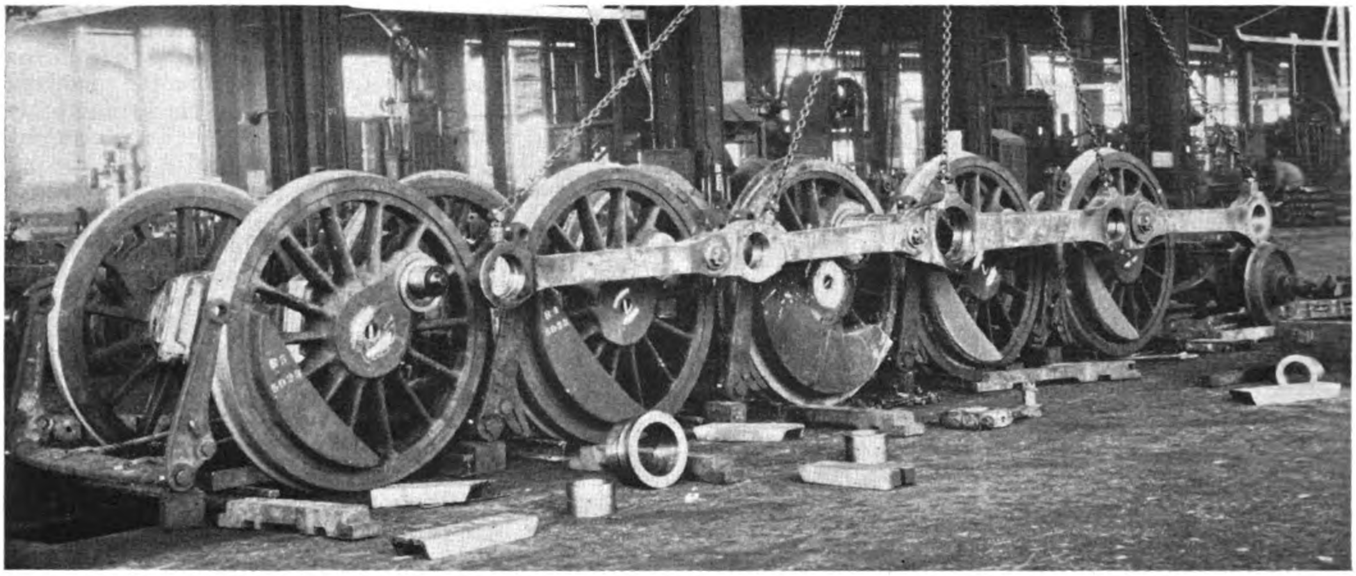
Wheeling Locomotives

THE wheeling of locomotives is an operation which in itself does not take an excessive amount of time provided suitable advance preparation has been made and the work properly organized. Much study has been given to this subject and a number of more or less effective wheeling methods developed. The one shown in the two illustrations includes the location of wheels on the wheeling pit in the usual manner with driving boxes in place with the pedestal binders and wedges supported on blocking, brake beams and hangers in place and all side rods on the crank pins.

The method of supporting the binders is of interest, consisting of blocks or permanent jacks mounted on short longitudinal channel irons, which in turn are supported on scrap rails extending across the pit. After the wheeling operation, simply spreading the rails permits the channels with blocks or permanent jacks to drop into the pit. The rods on each side of the locomotive are moved as a unit by means of the shop crane from the rod job and applied to the wheels. With accurate tramming of the rods as well as careful lining of the shoes and wedges, all parts fit together accurately and the wheeling of the locomotive proceeds without difficulty or delay. The locomotive is lowered carefully by the shop crane until the binders are in place, the binder nuts then being applied without difficulty. Brake



End view of wheels, binders, wedges, brake rigging and trailer truck assembled ready for wheeling



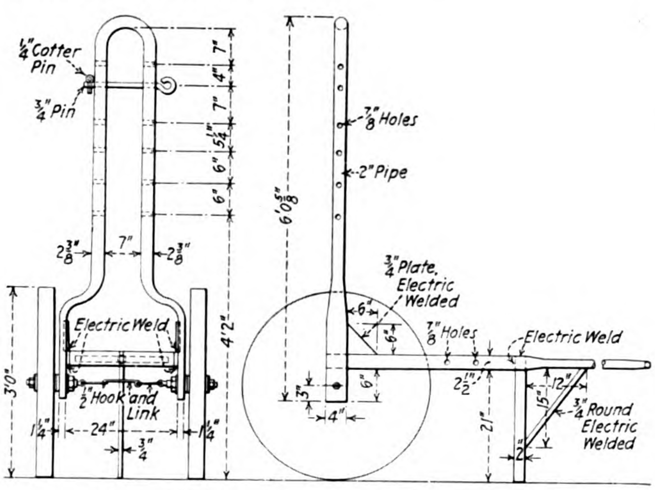
Labor-saving method of applying side rods to 2-10-2 type locomotive—The chains are all suspended from the crane hook

hangers, beams and rods, having been previously assembled in place are applied by the simple process of inserting brake-hangar pins and cotters. The side rods are already on and the locomotive is therefore ready to be lifted to the center track or pulled out of the shop as soon as the blocking is dropped. The second illustration gives an end view of the wheeling arrangement just before the locomotive is lowered onto its wheels.

It is estimated that this method of wheeling locomotives saves approximately 45 man-hours in rod handling, 20 man-hours in brake-rigging application, and 20 man-hours in the wheeling operation itself. While a little longer is taken in getting ready for the actual wheeling operation, the locomotive, once wheeled, requires little more work to make it ready to leave the shop and be conditioned for the trial runs.

Handy Tire Wagon For the Back Shop

THE tire wagon shown in the drawing can be used for handling tires of all sizes. The frame is of forged wrought steel and electrically welded. The wheels are of cast iron.

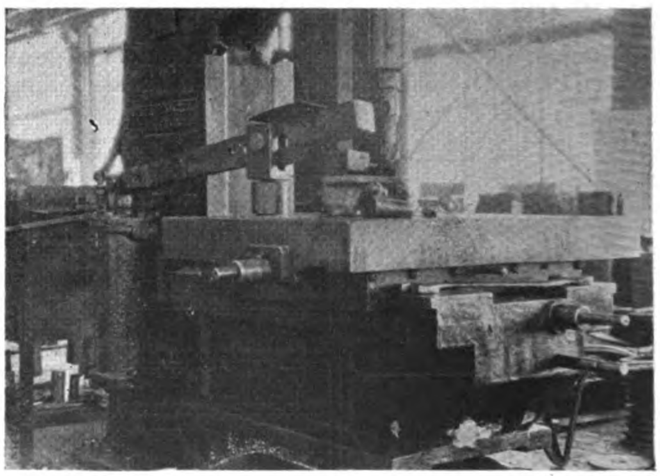


Wagon for handling tires of various sizes

A 3/4-in. pin is used to support and hold the tire in position. To prevent interference with the axle, but at the same time give the cart the necessary rigidity, a 1/2-in. hook and link is used to attach the two wheel-journal connections. It is unhooked when loading and hooked after the tire is in place.

An Air Clamp For the Drill Press

PNEUMATIC clamps for drill presses are not new, as compressed-air power is frequently used to clamp the tools in a wheel lathe, and to clamp down the tail stock of the same machine. The illustration shows a shop-made drill-press clamp which utilizes an old loco-



Air clamp for drill press made from an old locomotive ash-pan cylinder

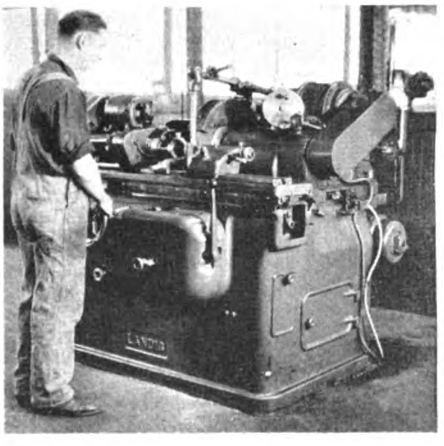
motive ash-pan cylinder. The fulcrum hole in the lever is slotted and the lever may be swung about to serve practically any part of the table. This press is used on brake shoes, brake beams, equalizers, and other flat work where many duplicate parts are handled, frequently on a production or piece-work basis for stock or shipment to outlying points.

NEW DEVICES

Landis Plain Hydraulic Grinder

The Landis Tool Company, Waynesboro, Pa., has developed a hydraulic grinder which makes available a comparatively small rapid traverse plain grinding machine, highly flexible but at the same time ideal for the mass production of light parts. It is recommended for such work as small bearings, small motor armatures, light shafts and all work of a similar nature.

The outstanding feature of the machine is its productiveness coupled with ease of operation. Such ease of operation is achieved by smoothness of all machine movements and by a skillful grouping of the controls. Hydraulic table traverse gives a range of table speeds from 6 in.



Landis hydraulic grinder for the rapid production of small parts

to 240 in. per minute. Accessibility to the various mechanisms is another desirable feature. By removing the large cover at the front of the bed all control mechanisms are exposed. None of them is entirely within the bed. The design of the complete pump mounting is such as to make it quite accessible.

The bed is of box-type construction. The water reservoir is integral with it while its base forms a reservoir for the oil used by the hydraulic traversing system. The work carriage traverses on a flat guide and a V-guide with one vertical side; both guides having chilled surfaces. Guide-way lubrication is of the flood-type, filtered oil being used and being supplied by the same oil pump which furnishes pressure for the hydraulic system. Provision is made for the tarrying of the work carriage at reversing points.

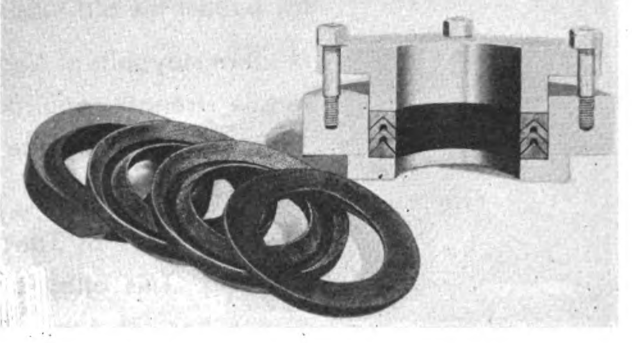
The hydraulic system consists of a twin-cylinder-type table-traversing mechanism and a Tuthill internally geared oil pump. Because of the use of twin cylinders, the control valve is made to govern the flow of oil from the end of one cylinder into the corresponding end of the other, thus giving an unusual smoothness of operation. The oil pump is mounted on the rear of the bed where it, along with the water pump, is driven by a constant-speed motor.

Standard equipment includes a plain wheel-feed mechanism. At extra cost a hydraulic automatic wheel-feed mechanism may be supplied or, for certain high production jobs, a hydraulic straight infeed mechanism is also available. The headstock is driven by a constant-speed motor. Four work speeds are made possible by changing the pulley and the belts at the left-hand end of the head.

This machine is available in a 6-in. by 18-in. size which weighs 3,750 lb. net, without electrical equipment and also in a 6-in. by 30-in. size which weighs 4,000 lb. net, without electrical equipment. Constant-speed motors are used throughout; a 1/3-hp. for the headstock, a 1-hp. for the pump drive and a 3-hp. for the wheel-spindle drive.

Garlock Chevron Packing

The Garlock Packing Company, Palmyra, N. Y. recently brought out a packing which, because of its peculiar construction, is designated as Chevron-430 packing. It is designed for use on rams and plungers of accumulators, presses, pumps and other heavy-duty hydraulic equipment. It is referred to as an automatic packing, its design permitting the use of a plurality of rings in shallow stuffing boxes which will not accommodate a suitable number of rings of ordinary packing. This feature is illustrated.



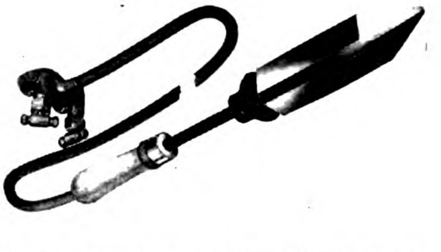
The Garlock 430 Chevron packing (Patented)

For a high temperature service this company is manufacturing a packing which is of the same type and design as the Garlock-430 Chevron packing, but which is constructed of heat resisting materials. This is designated as the Garlock-530 Chevron packing. Both types can be made to specifications for all sizes of stuffing boxes, each set of packing being provided with top and bottom adapter rings conforming respectively to the level of the gland and the stuffing box.

Gas-Heated Soldering Iron

Increased efficiency and greater economy are two of the outstanding advantages of the new "Torchiron" gas-heated soldering iron recently introduced by the Reliance Specialties Manufacturing Company, 122 East Forty-Second street, New York.

Using the "Torchiron," the operator has a continuously heated soldering iron



The temperature of this soldering iron may be varied by regulating needle valves

for steady work. With the 3-lb. head, the fuel required is only 4 or 5 cu. ft. of gas per hour, and with the 5-lb. head, 5 or 6 cu. ft. of gas per hour. This iron is heated by either natural or artificial gas and low-pressure air mixed by means of a needle valve, and passing through a flexible hose to the handle of the torch, making it easy to operate.

Constant temperatures are increased or decreased at the option of the operator by regulation of the needle valve. The copper heads may be brought to a red heat within three to five minutes after lighting. A great deal of the filing and cleaning, dipping and retinning of the coppers is eliminated, inasmuch as the copper heads are not exposed to the open flame.

Coppers are available in sizes ranging from 1/2 to 5 lb. They also are made to specifications. The coppers are quickly interchangeable, being screwed on to the stainless-steel tip. As the name implies, the "Torchiron" may be used as a torch as well as an iron, merely by removing the copper head.

(Continued on next left-hand page)

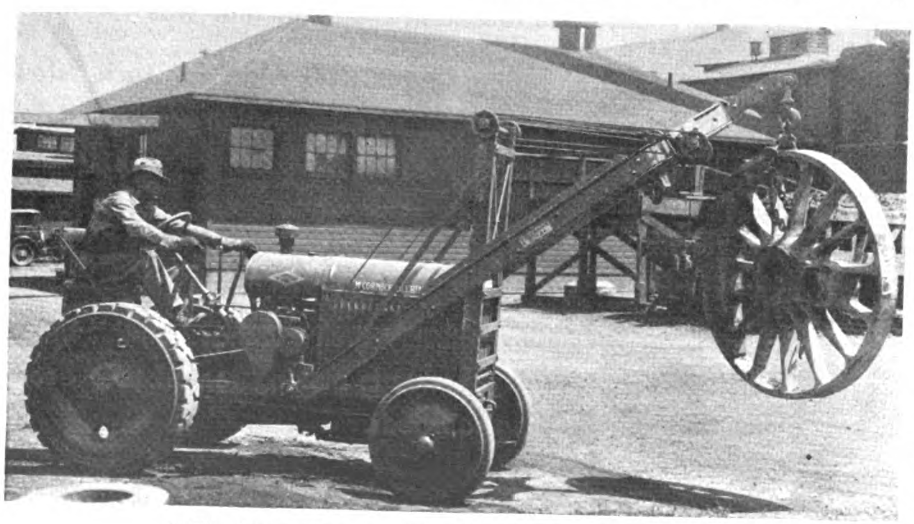
Diamond U-Type Hydraulic Packing

The Diamond Rubber Company, Akron, Ohio, has developed a new product, known as "Rubber Crimps," or U-type hydraulic packing, for service on hydraulic rams and presses. The new packing is made in rings of standard sizes, with a U-shape cross section. The rubber is especially compounded to resist oil and is covered almost completely with a layer of fabric which adds considerable strength and helps to maintain the ¼-in. flare at the bottom.

The following advantages are claimed for this packing: Low cost; suitable for use with pressures up to 3,000 lb. and more; not affected by the heat generated in a hydraulic press; wears slowly and evenly; it fits snugly against the ram at all times, making a tight seal, even when the ram is imperfect; thickness vertically through center is ¾ in., which serves to stiffen the flare and increase the strength and life of the packing and it will not dry up when a press is idle.

Trackson Industrial Tractor Crane

The Trackson Company, 500 Clinton street, Milwaukee, Wis., has developed an industrial crane mounted on a McCormick-Deering tractor for use in and around shops and yards. The unit is designed to speed up such jobs as lifting, spotting cars, carrying car parts, sills, wheels, rails or other heavy or unwieldy weights. This improved Trackson crane has a new hoisting mechanism controlled by a single lever which operates both the clutch and the brake, giving the operator complete control of the crane and its load at all times. When the lever is pulled back the boom raises. In the neutral position the clutch is disengaged and the brake is applied. A slight forward pressure on the same lever releases the brake and allows the boom to lower. The entire operation of the tractor and crane may be performed by one man.

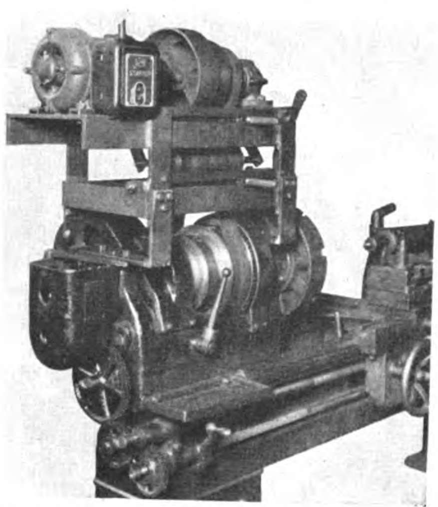


A Trackson crane handling locomotive wheel centers

Motorized Unit For Machine Tools

The Production Equipment Company, Cleveland, Ohio, has recently developed a motorized unit drive for machine tools which makes it economically possible to change belt-driven machines to motor drive. This is accomplished by the application of a specially designed unit-type drive which performs the functions of line shaft and countershaft.

The complete motorized unit consists of the base and the drive unit. Two styles



A motorized unit with box-type base and idler pulley applied to a lathe

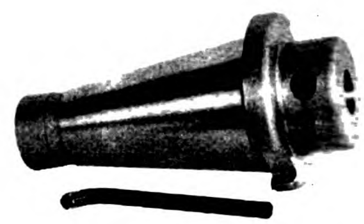
of bases are regularly used—the box type and the overhung type—depending upon the type of machine tool to which the application is made. The box-type base provides support at all bearing points and assures accurate alinement under all operating conditions. It permits the ready mounting of an idler pulley and belt shifter, thus giving a complete unit which will meet practically any engineering or safety requirement. The box-type base is usually supplied with two U-shaped supporting members which are mounted directly over the spindle-bearing caps. The belt is entirely inside the box construction and, to comply with the safety codes, a mechanical belt shifter can be built in and wire mesh covers furnished for the box. The box-type mounting also permits the use of an idler pulley which makes possible heavier cuts than can be made when a machine is driven from a line shaft.

The overhung type of drive utilizes a base mounting on a welded steel base supported from a structural-steel column which is bolted to the side or rear of the machine. The countershaft base is hinged at the upper end of the column and the belt tension is adjusted by means of a simple cam operated by an adjusting lever. The overhung type of base is usually used without the mechanical belt shifter or the idler pulley, although these auxiliaries may be used if desired.

The drive unit consists of a speed reducer with an extended shaft to which the drive pulley is keyed. The shaft has an outboard bearing. The speed of the extended shaft is designed to duplicate the normal speed of a countershaft. The unit is supplied in ratings from ½ to 20 hp. in single- or multi-speed designs, reversible if desired. This type of drive may be used with either single-pulley or cone-type machines. The electrical equipment is fitted with push-button control.

Brown & Sharpe Small Tools

The Brown & Sharpe Manufacturing Company, Providence, R. I., has recently announced some new cutter adapters,



One of the cutter adapters for use with the standard milling-machine spindle

spiral two-lipped end-mills, arbors for shell end-mills and screw arbors for use with these adapters, which have some unusual features of design.

The adapters are furnished in two different styles for use with milling machines having the standardized spindle end and, also, in one style for use on milling machines having taper or threaded-nose spindle. The adapters are furnished with a milling-machine standard taper hole into which the shank of the end mill or arbor fits.

The end mill or arbor is held securely to its seat by a cam furnishing a positive drive. The surface of the cam engages the flat surface of the groove in the shank of the cutter. When the cam is turned to release it, the cutter or arbor drops from the adapter, the steep taper preventing sticking and insuring quick release. These adapters, arbors and end mills are furnished in a desirable range of sizes.

(Continued on next left hand page)

NEWS

More Air-Conditioned Equipment on the B. & O.

In order to meet the popular demand for air-cooled cars, the Baltimore & Ohio has added air-conditioning equipment to two more of its trains between Washington, D. C., and New York, one leaving Washington daily at 9:10 a. m., and the other leaving New York (Jersey City) at 9:30 a. m. Beginning Monday, July 20, trains No. 6 and 523 will be equipped with the air-conditioned cars, consisting of smoking-lounge car, latest type parlor cars, individual seat coaches and colonial dining car.

The first air-conditioned train, which started on May 24, was the "Columbian," between Washington and New York.

Court Sanctions L. & N. Shop Closing

The federal district court at Louisville, Ky., on July 6, issued a temporary injunction restraining the city of Cloverport (Ky.) from attempting to compel the Louisville & Nashville to fulfill a contract which provides for the maintenance of shop facilities at that point. The court held that the city is entitled to a jury trial to determine the amount of damages, not in excess of $20,000, to which it may be entitled. The contract with the city was originally made by the Louisville, St. Louis & Texas, and provided that the road's shops should be located at Cloverport in return for the proceeds from the sale of $20,000 city bonds. When the L. & N. purchased the Louisville, Henderson & St. Louis, the successor of the L., St. L. & T., the shops at Cloverport were abandoned.

Rock Island to Convert Locomotives for Oil Burning

The Chicago, Rock Island & Pacific plans the immediate conversion of 231 additional locomotives used on its lines south and west of Kansas City, Mo., from coal burning to oil burning. The conversion will involve the construction of 13 roadside stations for fuel oil on the lines between Kansas City and Belleville, Kan., and between Herington, Kan., and El Reno, Okla., including a number of branch lines in Oklahoma.

Oil stations will be located at Topeka, Kan., Cline, Caldwell, Clay Center, McFarland, Armourdale, and Herington; Haileyville, Okla., Hobart, Lawton, Enid, Ardmore, and Anadarko. The work of converting the engines will be done in the Rock Island shops and the working time there will be increased beginning July 13. It is expected that it will require from 60 to 90 days to complete the conversion.

When completed, this conversion will effect decided economies in operation on the basis of present fuel oil prices. Locomotives on the Arkansas-Louisiana and the Oklahoma divisions of the Rock Island were changed from coal to oil burning in 1930 and on the El Paso-Amarillo and Pan-Handle Indian Territory divisions in 1928.

Salary Reductions

The Canadian National on August 1 reduced all salaries of over $3,600 by 10 per cent for a period of ten months. The reduction applies to employees whose rates of pay are governed by scheduled agreements. Sir Henry Thornton, chairman and president of the Canadian National, said in Montreal that the reduction, despite his contract with the government definitely fixing his compensation, nevertheless included himself, and also all the higher officers of the system.

The Delaware & Hudson has made a reduction of 10 per cent in the salaries of officers, so far as approved by the president, in all positions where the salaries are equal to or greater than those paid to division superintendents or officers of corresponding rank.

A report of reduction in salaries of officers by the Southern Railway has been published in Washington, D. C., but the only statement authorized by the road is that there has been a voluntary reduction of salaries by officers which was not intended to be made public.

Wage adjustments affecting officers and clerical forces of the Missouri Pacific were made effective August 1 and employees will now work and receive pay for five days a week instead of five and one-half, as at present. Officers and unorganized workers will continue to work 5½ days and will receive weekly reductions equal to one day's pay. The adjustment does not apply to employees in train service.

Power Reverse Gear Hearings Adjourned to September

Hearings before Special Examiner J. L. Rogers of the Interstate Commerce Commission on the complaint filed by the two enginemen's brotherhoods asking the commission to require that all locomotives be equipped with power reverse gear have been adjourned until September 28, when the rebuttal testimony on behalf of the railroads will be continued. The roads have thus far put on the stand 118 witnesses, of which approximately one hundred were locomotive enginemen who disagreed with the witnesses presented on behalf of the brotherhoods and took the position that in the present stage of development the power reverse gear is not sufficiently safe and efficient to warrant its application to all locomotives.

(Continued on fourth left-hand page)

Domestic Orders Reported During July, 1931

Locomotives

Name of Company	No. Ordered	Type	Builder
Bangor & Aroostook	2	Switching	American Locomotive Company
Chicago, Burlington & Quincy	1	Switching	Whitcomb Locomotive Company
Total for month of July	3		

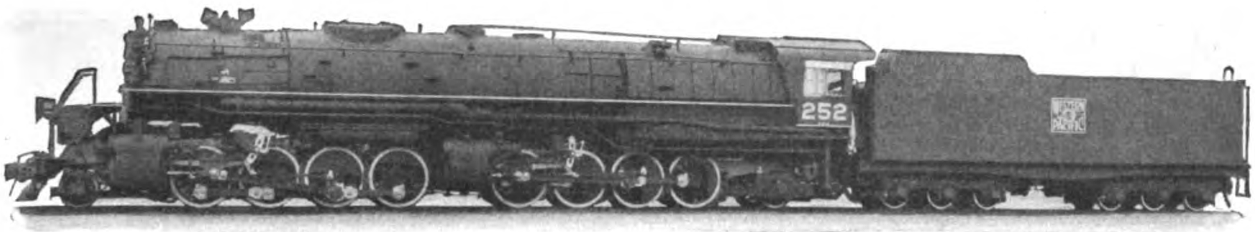
Freight Cars

Name of Company	No. Ordered	Type	Builder
Tennessee Coal, Iron & Railroad Company	4	Flat	Pullman Car & Mfg. Corp.
	4	Sheet, bar and steel-transfer	
Chicago & Illinois Midland	4	Caboose	Pullman Car & Mfg. Corp.
Navy Department of U. S. Government	6	Tank (helium)	General American Tank Car Corp.
American Railroad of Porto Rico	200	Sugar-cane	Gregg Company
L. C. L. Corporation	225	Container	American Car & Foundry Company
Total for Month of July	143		

For Fast Freight Service

on the

Western Pacific



2-8-8-2 TYPE LOCOMOTIVE
WESTERN PACIFIC RAILROAD

Cylinders (4)	26" x 32"
Drivers, diameter	63"
Steam pressure	235 lb.
Grate area	145 sq. ft.
Water heating surface	6880 sq. ft.
Superheating surface	2152 sq. ft.
Weight on drivers	552,700 lb.
Weight, total engine	665,100 lb.
Tractive force, main cylinders	137,000 lb.
Tractive force, with booster	150,900 lb.

THE WESTERN PACIFIC handles a large tonnage of freight, particularly fruits and vegetables, which moves on fast schedules.

To maintain the speed and to permit the handling of trains without helpers, this Railroad is placing in service six single-expansion oil burning Mallet locomotives of the 2-8-8-2 type built by The Baldwin Locomotive Works.

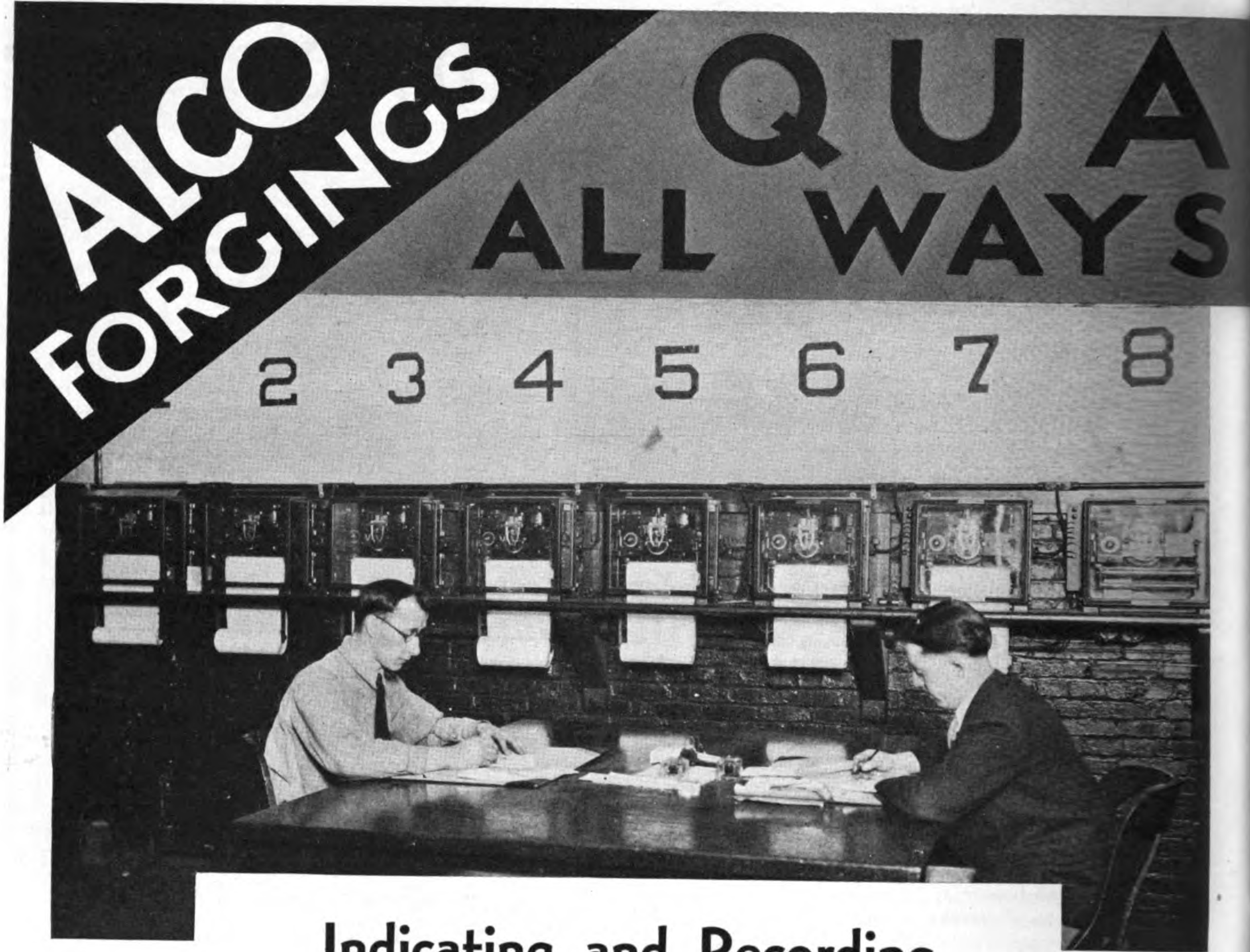
These are high-power locomotives capable of hauling greater tonnage, at a sustained high speed, than locomotives now in use. They were especially designed to meet operating problems on the line of the Western Pacific in the Feather River Canyon of the Sierra Nevada Mountains.

These locomotives are among the most notable of this type recently built.

THE BALDWIN LOCOMOTIVE WORKS 1831 1931

THE BALDWIN LOCOMOTIVE WORKS

PHILADELPHIA


ALCO
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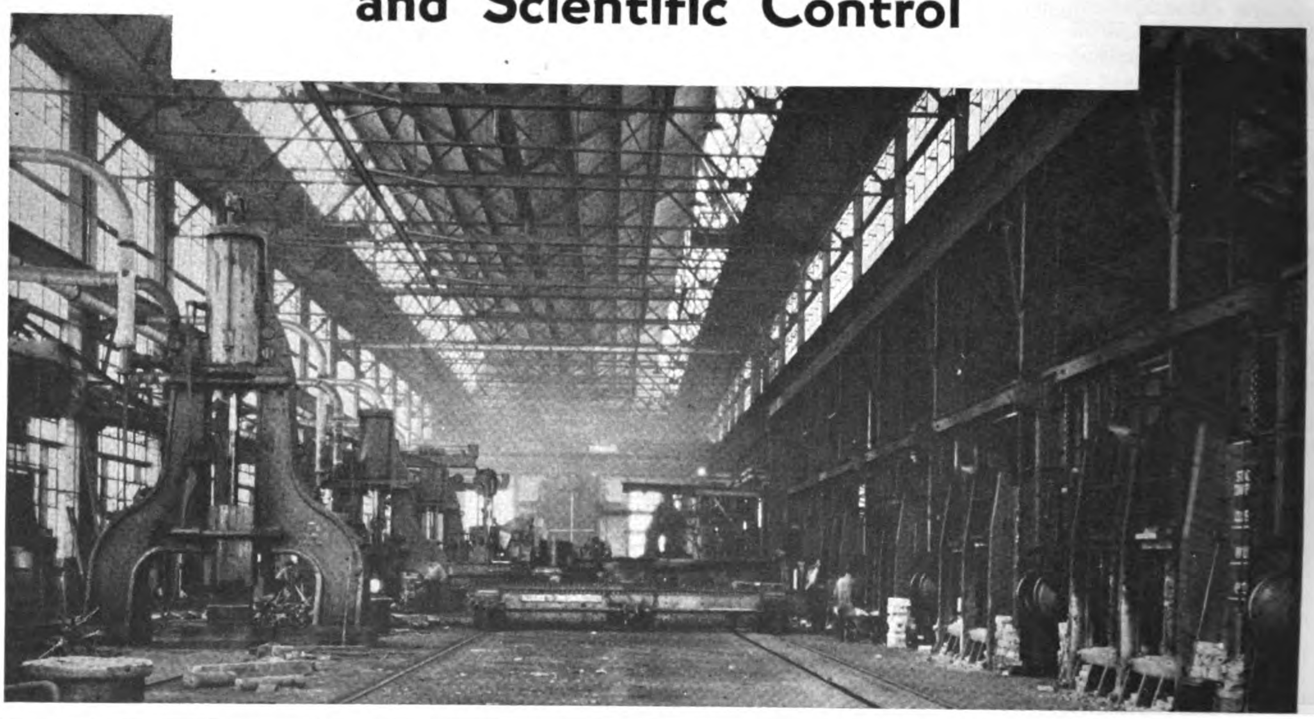
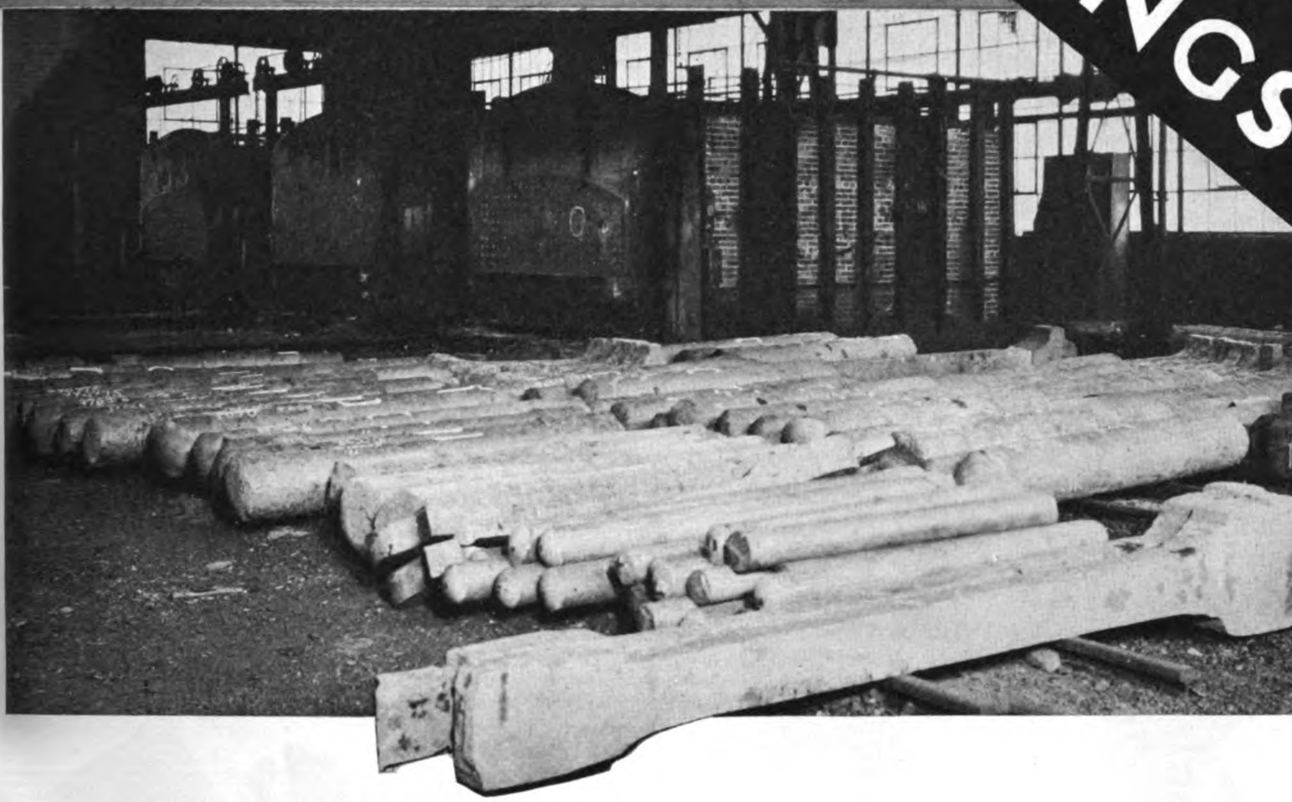


LITY ALWAYS

ALCO FORGINGS



QUALITY billets are the sound foundation of all Alco quality forgings. But that is only the start. Heat treating before forging is of vital importance. That is why Alco exercises particular care and supervision to this phase in the manufacture of all Alco Forgings.

Proper heat treating is important because steel should not be charged into a hot furnace, as this often causes internal ruptures. This is especially true for the alloys and the higher carbon steels and even for medium steels in cold weather.

To avoid damage to the billets and to insure complete control over the heating of the steel before forging, six regenerative furnaces have been installed in the Alco Plant. In normal operation there are two cool furnaces ready for charging, two hot furnaces containing steel ready for the press and hammer, and the remaining two cooling off. These furnaces are oil-fired—the flame at no time comes in direct contact with the charge in the furnace—and all the furnaces are equipped with indicating and recording pyrometers.

This equipment furnishes a continuous and complete record of the forging during heating and enables us to know the rate at which the heat was applied, the time of soaking at heat to insure proper penetration, and that the proper temperature had been reached before withdrawing for forging.

The scientific execution of even the smallest detail in the heat treating process assures high quality forgings of great strength, uniformity, toughness and durability.

Alco Quality Forgings make good locomotives better—they multiply the utility and economy of your motive power both old and new.

Specify Alco Forgings — you get quality all ways always, from billet to finished forging.

American Locomotive Company

30 Church Street New York N.Y.

Supply Trade Notes

H. W. Kelsey, general sales manager of the Russell Manufacturing Company, Middletown, Conn., has been promoted to take charge of all purchases of his company.

Ellsworth L. Mills, formerly sales manager of the Bastian-Blessing Company, Chicago, makers of welding equipment, has been elected vice-president. Mr. Mills continues in charge of sales.

George Kirtley has been appointed general sales manager of the H. K. Porter Company, with headquarters at Pittsburgh, Pa., to succeed Harvey Lefevre, who has resigned to go into other business.

C. N. Johns has been appointed general manager of the Page Steel & Wire Company, with headquarters at Monessen, Pa., and W. H. Bleecker, Jr., has been appointed sales manager, with headquarters at 701 American Bank building, Pittsburgh.

George D. Bassett, vice-president of Crerar, Adams & Co., Chicago, has resigned to become manager of the railroad department of the H. Channon Company, Chicago, J. L. Taylor, vice-president in charge of railroad sales, having been assigned to other duties. Mr. Bassett was born in Batavia, Ill., on May 17, 1863. He entered railway service as a clerk in the store department of the Chicago & North Western and on June 16, 1879, entered the employ of Crerar, Adams & Company as an office boy. In 1898, he was promoted to salesman and in 1924, to vice-president.

George D. Bassett

Charles D. MacGillivray, assistant secretary of the Baldwin Locomotive Works, has been elected secretary to succeed Arthur L. Church, deceased, and J. Harrison Kerst has been elected assistant secretary, both with headquarters at Eddystone, Pa. Mr. MacGillivray and Mr. Kerst were also elected to similar positions with two Baldwin subsidiary companies, the Standard Steel Works Company and the Baldwin-Southwark Corporation.

L. F. Wilson, who has been elected president of the Wilson Engineering Corporation, Chicago, a company organized to manufacture, engineer and market the mechanical equipment and devices heretofore handled by the Bird-Archer Company, was born at Rush Lake, Wis., on November 4, 1883, and received his education at Ripon College, Lawrence University and the University of Wisconsin. He entered the railroad field as a telegraph operator and locomotive fireman on the Chicago, Milwaukee, St. Paul & Pacific. From 1906 to 1909 he was in the engineering department of the Western Electric Company, and from the latter date until 1911 was assistant editor of the Railway Review (now combined with the Railway Age) and for the following three years was editor of the Railway Master Mechanic (now combined with the *Railway Mechanical Engineer*). In 1914 he was appointed district manager of the Bird-Archer Company, which position he held until 1919. During the year 1917-18 he was also captain in the Quartermaster Corps of the U. S. Army, and from 1918 to 1926 was a major in the engineering division. In 1926 he was appointed lieutenant-commander of the U. S. Naval Reserve. From 1919 to 1928 he was vice-president and general manager of the Bird-Archer Company, and in the latter year he was elected president and general manager, which position he has held until his recent appointment.

L. F. Wilson

V. E. McCoy

V. E. McCoy, who has been appointed treasurer and mechanical engineer of the Wilson Engineering Corporation, was born on December 17, 1900, at Lincoln, Neb., and graduated from Montana State College in 1925. He entered the service of the Chicago, Milwaukee, St. Paul & Pacific as special apprentice in July, 1925, and served as combustion engineer from 1928 to 1929. In January, 1930, he was appointed assistant to the president of the Bird-Archer Company, which position he held until his recent appointment.

The Westinghouse Air Brake Company has announced that Professor S. W. Dudley, Strathcona Professor of Mechanical Engineering and chairman of the Department of Mechanical Engineering in Yale University, has rejoined its engineering organization in an advisory capacity with the title of assistant to the vice-president, while retaining his university connections. After completion of his college course in mechanical engineering at Yale University and a short period of service on the faculty, Professor Dudley entered the employ of the Westinghouse Air Brake Company as a special apprentice in 1905 and advanced steadily until he was appointed chief engineer in 1914, which position he retained until 1921 when he accepted the chair of mechanical engineering in his Alma Mater. Many outstanding air brake developments mark the period during which he was associated with this company, and in these achievements he had a prominent part. Because of his broad experience, pleasing personality, and keen insight into human affairs as well as engineering practices, Professor Dudley has been in demand for various activities and positions of responsibility with the college. He is a member of the board of trustees and governing board of Sheffield Scientific School, chairman of the University Committee on Transportation, member of the Industrial Committee of the Institute of Human Relations in Yale, and member of

S. W. Dudley

(Continued on next left-hand page)

the Committee on Relations between Railroads and Colleges of the Society for the Promotion of Engineering Education. He is a member of the Publication Committee of the American Society of Mechanical Engineers, was formerly chairman of its Meetings and Program Committee, and also headed the committee in charge of its Fiftieth Anniversary celebration in 1930.

WILLIM N. THORNBURGH, president and treasurer of the William N. Thornburgh Manufacturing Company, Cicero, Ill., who died on June 18, had been engaged in railway service and manufacturing for 44 years. He was born at Cleveland, Ohio, on September 15, 1866, and obtained his first railway experience in 1887 as a telegraph operator on the Baltimore & Ohio. Later he served as a chief clerk in the

William N. Thornburgh

traffic department of that railroad, where he remained until he became manager and treasurer of the Thornburgh Coupler & Attachments, Ltd., Detroit, Mich. He then organized the Thornburgh Draft Gear Company, following which he established the William N. Thornburgh Manufacturing Company for the manufacture of dust guards for railroad journal boxes. Mr. Thornburgh's widow, Mrs. M. M. Thornburgh will continue the operation of the company.

RALPH M. HOFFMAN, for eight years manager of the Seattle office of the Pacific division of the Link-Belt Company, has been appointed vice-president and sales manager of that division, with headquarters at San Francisco, Cal. He succeeds Harold H. Clark who retired on June 1.

THE GENERAL MACHINERY CORPORATION, Hamilton, Ohio, has acquired the business of the Putnam Machine Company, Fitchburg, Mass., formerly owned by Manning, Maxwell & Moore, Inc. The Putnam line of products will continue to be manufactured at the General Machinery Corporation's plants as supplementary to the line of The Niles Tool Works Company, another subsidiary of General Machinery Corporation. The company will furnish, and solicits repairs for, all existing Putnam, Dietrich & Harvey, and Beaman & Smith installations. The business will in future be conducted as the Putnam Machine Company, division of General Machinery Corporation. G. A. Rentschler, president of the General Machinery Corporation, is also president of Putnam Machine Company.

CHARLES P. WHITEHEAD, sales assistant to the vice-president and general manager of the General Steel Castings Corporation, Granite City, Ill., has been promoted to manager of sales, with headquarters at Eddystone, Pa. William M. Sheehan, sales assistant to the vice-president and general manager, with headquarters at Eddystone, Pa., has been appointed manager of the Eastern district sales, with the same headquarters. Harry R. Bartell, sales engineer, has been promoted to manager of the Western district sales, with headquarters at Granite City. E. J. Birtwell continues as district manager of miscellaneous sales at Eddystone.

Obituary

H. OTTO WITTPENN, president of the Ardco Manufacturing Company, Hoboken, N. J., died at his home in that city on July 25. Mr. Wittpenn was born on October 21, 1872, at Jersey City, N. J., and was educated in the public schools of that city and schools in Germany. At the time of his death, Mr. Wittpenn was a director of the Morris & Essex Railroad Company and president or a director of several industrial and financial organizations. He had taken an active part in civic affairs, having served as mayor of Jersey City for three terms, and for two terms was comptroller of the Port of New York, under appointment of President Woodrow Wilson. He also served as New Jersey state highway commissioner from 1929 until the time of his death.

Personal Mention

General

R. C. Mohler has been appointed mechanical superintendent of the Southern Persian State Railways, with headquarters at Ahwaz, Persia.

Master Mechanics and Road Foremen

FOLLOWING THE consolidation of the Galveston and Beaumont divisions of the Gulf, Colorado & Santa Fe into one division, known as the Gulf division, C. F. Barnhill, master mechanic of the Beaumont division, has had his jurisdiction extended to include the Galveston division, with headquarters as before at Silsbee, Tex. R. E. Bell, master mechanic of the Galveston division at Galveston, has been assigned to other duties.

Obituary

S. A. WHITEHURST, master mechanic at the Savannah (Ga.) shops of the Central of Georgia, died on June 25 after a long illness. Mr. Whitehurst was born on October 12, 1868. He entered the employ of the Central of Georgia as a machinist in August, 1900, after having served about twelve years with other railroads. In February, 1902, he was appointed enginehouse foreman at Macon, Ga.; in 1905, general foreman at Chattanooga, Tenn.; in 1908, general foreman at Atlanta, and in 1909, master mechanic at Savannah.

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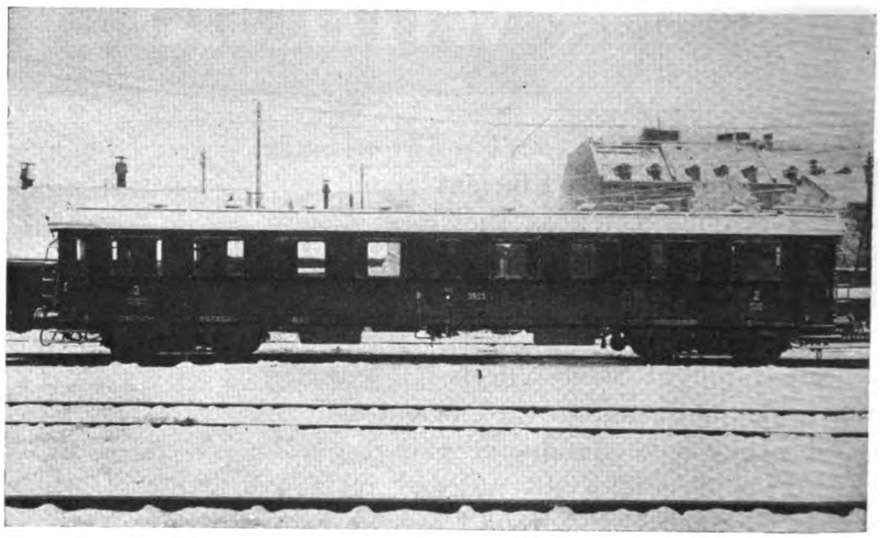

The latest type of second class passenger car to be put in service on the Swiss Federal Railways

This new second class car, entirely constructed of steel and iron, has recently been put in service by the Swiss Federal Railways. It is equipped with triple springs, and in spite of a trial speed of some 65 m.p.h., there was no vibration whatever. The new car is 65.62 ft. long, has 48 seats and weighs 41 tons. It can be heated electrically or with steam and has exceptionally swift-acting brakes. Instead of the customary two seats on each side of the aisle, this car has only three seats: i.e., one seat on one side and two on the other. The interior equipment consists of paneling in dark oak and cherry wood, with plush upholstering in shaded blue. The double ceiling is of a light color, and eight large ventilators provide an abundant circulation of fresh air. Every seat has a 40-watt shaded electric light with individual switch. Two blue lamps function automatically at night. Improved luggage racks are another innovation. It is expected that 18 cars of this latest type, a product of the car and elevator factory at Schlieren, near Zurich, will be put into service this year.

Trade Publications

Copies of Trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

Motors.—Bulletin No. 209, issued by the Reliance Electric & Engineering Company, Ivanhoe Road, Cleveland, Ohio, describes the Type T Reliance motors for direct current.

Insulating Firebrick.—B. & W. No. 80 insulating firebrick for furnace work is the subject of a bulletin issued by the Babcock & Wilcox Company, 85 Liberty street, New York.

Water Gages.—A new water gage, the Reliance Micasight, is described in a folder issued by the Reliance Gage Column Company, 5902 Carnegie avenue, Cleveland, Ohio. No glass is used in the design of this gage, the water line being clearly visible through windows of mica.

Wright Electric Hoists.—Outstanding features in electric-hoist design are pointed out in an eight-page folder issued by the Wright Manufacturing Company, Bridgeport, Conn. A more complete catalog gives prices and specifications on new Wright electric hoists.

"A Saving at Every Turn."—This is the title of Book 1293 issued by the Link-Belt Company, 910 South Michigan avenue, Chicago. The book describes the Link-Belt line of positive drives, including silent chain, roller chain, herringbone gears, P. I. V. gear drives, etc., and illustrates many of these positive drive units.

Two Men in a Pullman.—This is a small booklet, bound in cardboard, written by Franklin B. Evans for the G. M. Basford Company, 60 East Forty-Second street, New York. It is written in the narrative form of a conversation between two manufacturing executives in the smoking compartment of a Pullman. The subject of the conversation is good and bad advertising.

Pumps.—A circular, published by the Brown & Sharpe Manufacturing Company, Providence, R. I., lists the complete line of geared, vane and centrifugal pumps which this company manufactures for various pumping requirements, including hydraulically operated machines for supplying liquids under pressure, for circulation, for furnishing coolants to machine tools, etc.

Lathes.—The important units, features and specifications of the new model 9-in. Junior South Bend back-geared screw cutting precision lathe are described and illustrated in Junior catalog No. 22-C issued by the South Bend Lathe Works, South Bend, Ind. These are carried in stock by the A. C. Colby Machinery Company, 183 Centre street, New York, from whom copies of the catalog can also be obtained.

"Boiler Water Conditioning."—This is the title of a new 16-page treatise published by the Elgin Softener Corporation, Elgin, Ill. The book, printed in two colors, discusses various problems in the conditioning of boiler water and is profusely illustrated. There are chapters on Conditioning Boiler Water, Major Problems in the Use of Boiler Water, Chemistry of Boiler Water, Embrittlement, Standard Hook-Ups of Sludge Deconcentrators for Typical Types of Boilers, Continuous Blow Down with Heat Exchanger, etc.

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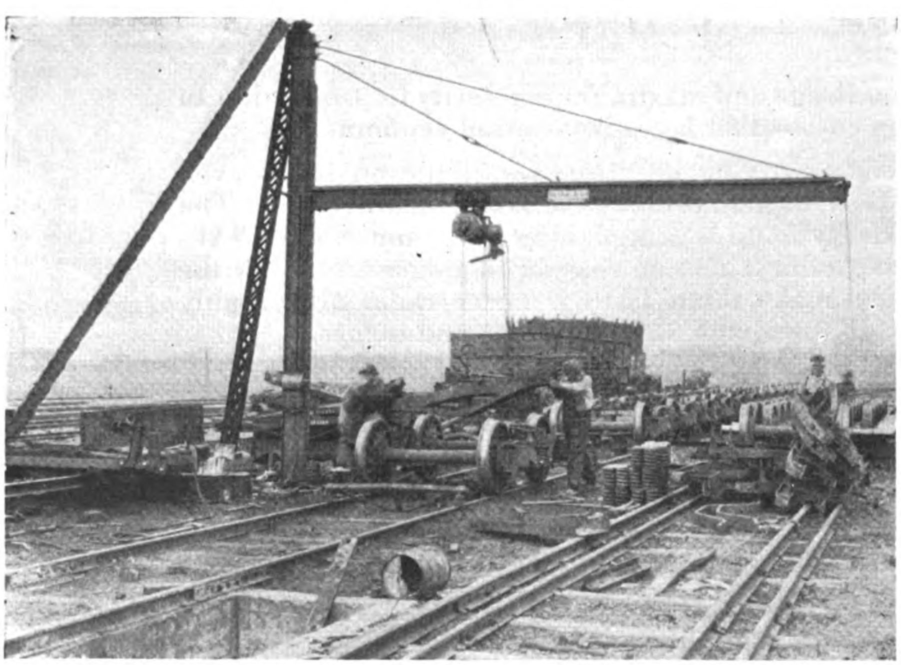

Application of a jib crane and electric hoist for handling truck repairs—Longitudinal concrete pits between the tracks facilitate the application of journal box bolts

Among the Clubs and Associations

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

Air-Brake Association.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

Allied Railway Supply Association.—F. W. Venton, Crane Company, Chicago.

American Railway Association.—Division V.—Mechanical.—V. R. Hawthorne, 59 East Van Buren street, Chicago.
Division V.—Equipment Painting Section.—V. R. Hawthorne, Chicago.
Division VI.—Purchases and Stores.—W. J. Farrell, 30 Vesey street, New York.
Division I. — Safety Section. — J. C. Caviston, 30 Vesey street, New York.
Division VIII.—Car Service Division.—C. A. Buch, Seventeenth and H streets, Washington, D. C.

American Railway Tool Foremen's Association.—G. G. Macina, 11402 Calumet avenue, Chicago.

American Society of Mechanical Engineers.—Carlin W. Rice, 29 W. Thirty-ninth street, New York.
Railroad Division—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York.
Machine Shop Practice Division. — Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.
Materials Handling Division.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.
Oil and Gas Power Division.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.
Fuels Division.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

American Society for Steel Treating.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

American Society for Testing Materials.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa.

American Welding Society.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

Association of Railway Electrical Engineers.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

Car Department Officers Association.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

International Railroad Master Blacksmith's Association.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

International Railway Fuel Association.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago. Business session, without exhibit or entertainment, September 15 and 16, Hotel Sherman, Chicago.

International Railway General Foremen's Association.—William Hall, 1061 W. Wabash street, Winona, Minn.

Master Boilermaker's Association. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

Master Car Builders' and Supervisors' Association.—See Car Department Officers Association.

National Safety Council—Steam Railroad Section.—W. A. Booth, Canadian National Montreal, Que. William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

Railway Business Association. — Frank W. Noxon, 1124 Woodward building, Washington, D. C.

Railway Fire Protection Association.—R. R. Hackett, Baltimore & Ohio, Baltimore, Md.

Railway Supply Manufacturers' Association.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

Supply Men's Association. — E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division American Railway Association.

Traveling Engineers' Association. — W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio.

Railway Mechanical Engineer

Founded in 1832 as the American Rail-Road Journal
With which are also incorporated the National Car Builder, American Engineer and Railroad Journal, and Railway Master Mechanic. Name Registered, U. S. Patent Office

September, 1931

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Motive Power Department:

Car Department:

General:

Editorials:

The Reader's Page:

Car Foremen and Inspectors:

Back Shop and Enginehouse:

New Devices:

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Railway
Mechanical Engineer

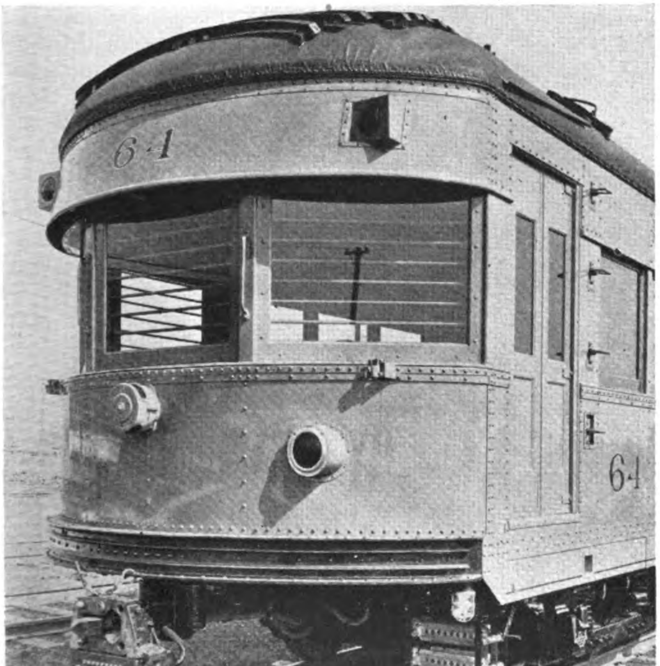
Founded in 1832 as the American Rail-Road Journal

September - 1931

Electric Line Installs High-Speed Aluminum Cars

Aluminum alloys used in the construction of the frames and body, except the bumpers—Also extensively used in the construction of the air brake and other equipment—Saving of 40,000 lb. in the light weight of each car

ELECTRIC railways, as well as steam roads, are giving increased consideration to light-weight equipment and high operating speeds, as indicated by the recent purchase of 35 multiple-unit cars equipped with high-speed motors and all-aluminum bodies by the Indiana Railroad System, an electric line which operates more than 5,000 miles of track, largely in Indiana. These cars, 21 of which were built by the Pullman Car & Manufacturing Corporation and 14 by the American Car & Foundry Company, are capable of speeds in excess of 70 m.p.h. and are expected to reduce the running time for the 123 miles between Fort Wayne, Ind., and Indianapolis, for example, to slightly over three hours. An equivalent running time will also be maintained for the 117 miles between Indianapolis and Louisville, Ky.



Rear view showing rounded end and roof construction, also Tomlinson car, air and electric coupler

Designed for interurban service, the new cars can be operated in multiple-unit trains, car connections being made by means of the Tomlinson No. 10, car, air and electric couplers, having manually-controlled, air-operated uncoupling mechanism. When run as single units, the cars are arranged for one-man operation. They have flush floors from end to end, the entrance and exit doors being at the front-end vestibules on the right side. The main passenger compartment carries 20 bucket-type fixed seats, each designed to accommodate two persons. The rear platform is arranged for baggage space with an emergency door on the right side. A toilet room with flushing hopper, wash basin and water-cooler is provided.

Fourteen of the cars are equipped with observation-lounge compartments, taking up the rear third of each car and having a seating capacity of 10, with 28 seats available in the coach compartment. The interior arrangement and equipment of all the cars afford maximum convenience and comfort. The coach chairs are upholstered with genuine leather, head and arm rests being provided for complete relaxation. Wide windows afford maximum visibility and produce ample light necessary for a bright and cheerful interior. Circulation of air is provided by means of ceiling ventilators, supplemented by two bracket fans on the front bulkhead.

During the winter months, the cars will be heated by automatic electric heating equipment, designed to maintain comfortable temperatures under all weather condi-

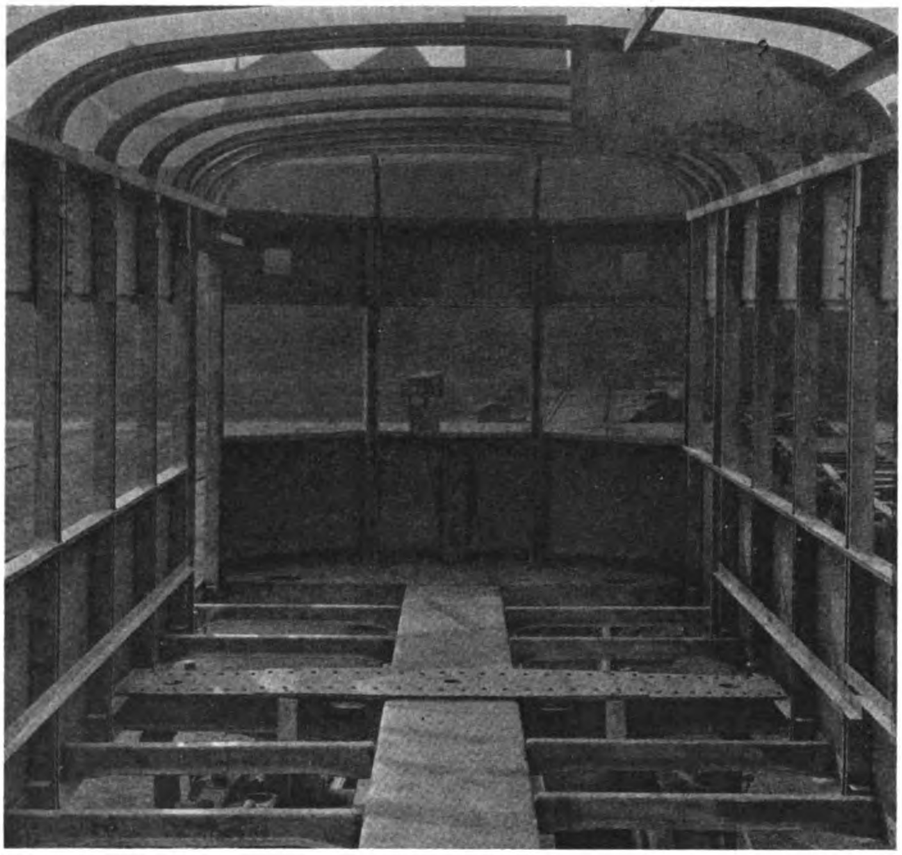
tions. Electric illumination is provided in the cars by means of a double row of ceiling lights of high intensity which will permit reading without eye strain. The lighting system is designed to provide a steady interior light whenever needed, independent of the trolley voltage. The compartments, decorated in two-tone shading on walls and ceilings, are furnished with thick carpeting, deep, upholstered chairs, solid American walnut tables, reading lamps and a pair of tapestry davenports. These compartments are available to all passengers without extra charge.

As shown in the table, each of the new cars is 46 ft. long between bumpers and has a light weight complete of 50,000 lb., being driven by four General Electric, 100-hp., 600-volt motors mounted on Commonwealth cast-steel trucks of the drop-equalizer type, equipped with Pullmanite journal boxes and American Steel Foundries Simplex multiple-unit clasp brakes. The car design provides an extremely low center of gravity which minimizes side sway as the car travels and makes it readily responsive to the controls. Wind resistance is reduced by the stream lines and rounded contours of the body construction.

Operation of the cars at high speeds of which the motors are capable is made safe through the use of strictly modern control and braking devices. Westinghouse standard HL non-automatic control, as well as the Westinghouse single-end safety car control equipment, with back-up feature, is provided, the cars being normally stopped by application of the clasp brakes mentioned. In addition, each car has a system of electromagnetic brakes which creates a magnetic field holding four special brake shoes against the rails and thus further increasing the braking power in emergency. Another safety feature in the control equipment is the provision for automatically shutting off the power and applying the brakes, if, for any reason, the motorman's hand releases the control.

Doubtless, the most important single feature of interest about the new Indiana multiple-unit car, from the point of view of steam railroad officers, is the extensive use of aluminum alloys in the car construction, and the methods of fabricating and handling this relatively new material. Practically the only steel used in the car body is the bumpers which are made of this material to meet the requirements of the state law. Many of the specialties, such as the Westinghouse air compressor, also are designed largely with aluminum parts so that aluminum is said to be used to a greater extent in this car than has ever been done before. In general, strong aluminum alloys are used for stress members and softer aluminum for the finished sheets. Since the completion of the car, it has been loaded in excess of the maximum body service load and stresses and deflections of the various parts of the car structures measured under these conditions. The stresses are said to be uniformly low, the deflections being kept strictly within good practice. The action of the car body under loading conditions is uniform, tests indicating that the stresses are well within the desired requirements and that there is a large factor of safety for all parts under operating conditions.

The light weight is 40,000 lb. less than that of older equipment replaced and, while all of this reduction cannot be credited to the aluminum alloys, the use of this material is responsible for a large proportion of it. The aluminum plates and shapes were handled in the shop without difficulty by car men accustomed to working with steel. No special precautions were necessary, except against overheating on the infrequent occasions when the aluminum shapes could not be formed cold. Welding operations, conducted by the experienced operators using the electric-arc process, were carried on much as in the case of steel construction. Weighing approximately one-third as much as equivalent steel shapes, the greatest difference noted in con-



Interior view showing the underframe and superstructure frame details

structing the car bodies of aluminum was the notably greater ease of handling sheets and fabricating parts in the shop.

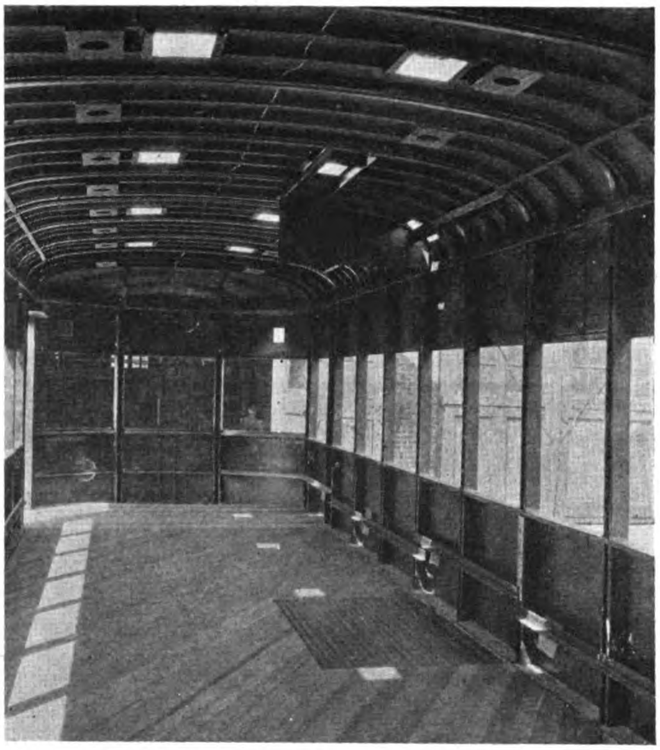
The center sill of the multiple-unit car is a strong-aluminum pressing ¼ in. thick, extending from bumper to bumper. As shown in one of the illustrations, it is an inverted U-shape, being 20 in. wide by 6½ in. deep and with 2⅝-in flanges. This U-shape was pressed cold in a hydraulic press equipped with suitable progress dies to form the desired shape gradually as the sheet was advance through the press. In accordance with recommended practice, the radius bends in the U-shape were made approximately four times the thickness of the material. Separators are applied in the center sill at the bolster and cross bearers and, where needed, at floor pans, all holes being punched in the center-sill sheet before it was formed in a U-shape.

The side sills are rolled, strong-aluminum angles, 4 in. by 3 in. by ¼-in., cut to the required length, and with all holes punched before assembly. The body bolsters and cross-bearers are built up of diaphragms pressed cold in a hydraulic press and provided with top and bottom cover plates, all of aluminum. Holes are punched in the diaphragms after pressing, largely to assure accurate location. The cover plates are sheared and pressed to the desired form and holes punched ready for assembly. The cross ties, or floor supports, are Z-shape, all being made of pressed aluminum. The body and platform end sills are also aluminum pressings of Z-shape with aluminum cover plates on the top and bottom extending to the bumpers. All underframe parts, after fabrication, were assembled by bolting together, holes reamed and hot steel rivets applied in the usual manner when building steel equipment.

General Dimensions of the Indiana Railroad All-Aluminum Multiple-Unit Car

Length over bumpers	46 ft. 0 in.
Truck centers	23 ft. 2 in.
Truck wheel base	6 ft. 6 in.
Width overall	8 ft. 10 13/16 in.
Height, rail to floor	3 ft. 5 5/16 in.
Height, rail to top of roof	11 ft. 1¼ in.
Seating capacity	40
Wheels, diameter	28 in.
Estimated light weight, complete car	50,000 lb.

Side and end posts of the multiple-unit cars are box-section aluminum pressings, the window sills also being aluminum pressings. The 2½-in. by ¼-in. belt rails are aluminum bars, end belt rails being of the same section but formed to suit the radius of the end of the car. Girder sheets about 2 ft. 10. in. deep on both the sides and ends are of aluminum. Extensions of the girder sheets are provided in the form of a skirt 8 in. below the side sills. The letter board and side plate are in one piece, the sheet being pressed to form the window lintel and the side plate. A pressed-aluminum carline is located at each side post to which a wood carline for fastening the roof boards is bolted. Intermediate wood carlines are provided for ventilator and lamp post supports. The roof is wood with canvas in one piece stretched across it as is usual with cars having trolley-pole current collectors. The floor also is wood laid diagonally in two layers with waterproof paper between and ⅛-in. linoleum on top, except in the baggage space where the top floor is of maple and in the toilet room where ½-in. masticoke is laid on the lower floor.



Interior view after application of the wooden floor and roof

The inside finish and headlining are of aluminum, the sheets being formed to the desired shapes and reinforcements spot welded to them for the application of brackets, etc. The toilet and partitions are of aluminum sheets. A water tank is located under the roof in the toilet. This tank, oval in shape, is made of aluminum

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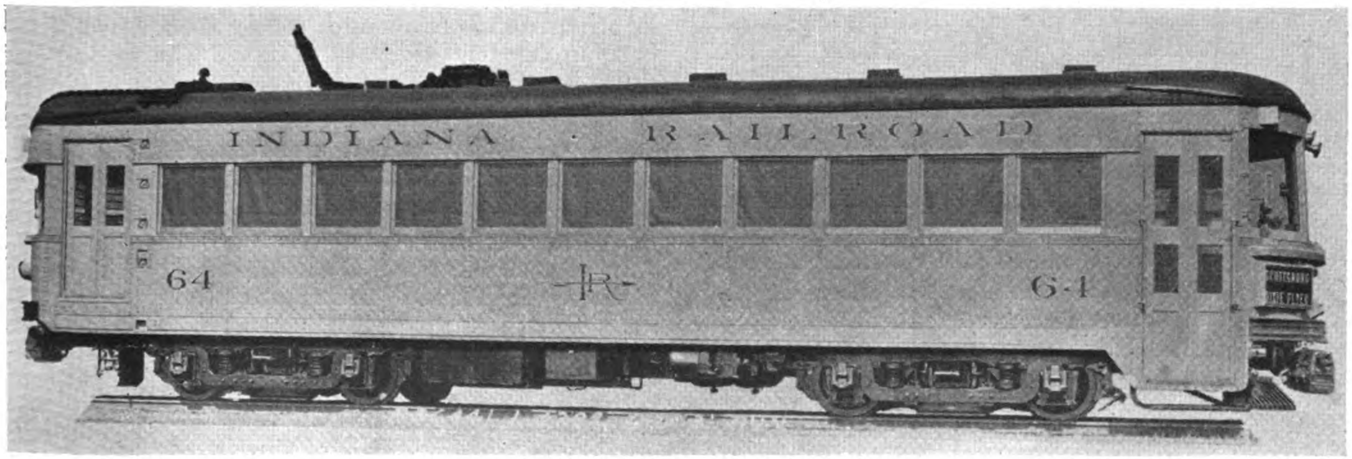


Multiple-unit car body embodying practically all-aluminum body construction

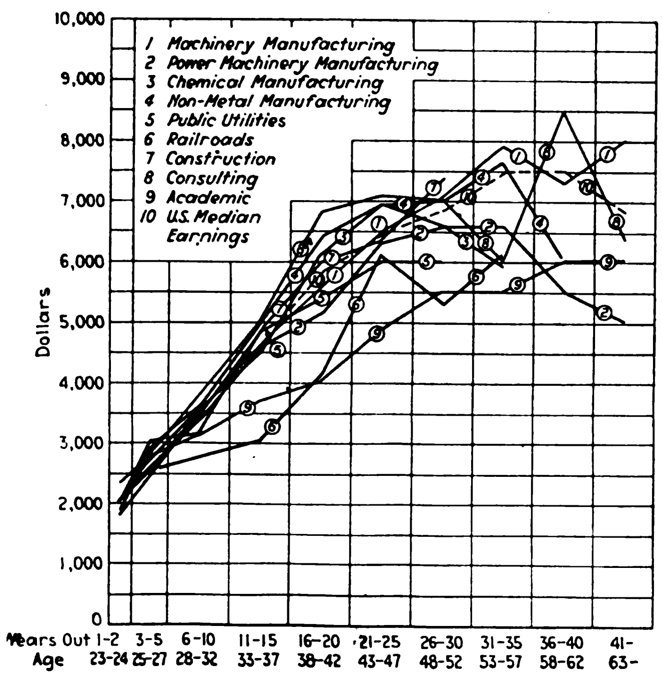
A. S. M. E. Reports That the Railroads Pay Low Salaries

Report by Committee on the Economic Status of the Engineer shows the median earnings of mechanical engineers in railroad service to be lower than the median earnings of mechanical engineers in any other industry —Earnings compare only with the teaching profession

THE Committee on the Economic Status of the Engineer, American Society of Mechanical Engineers, has reported that the median earnings of mechanical engineers in railroad service are lower than the median earnings of mechanical engineers in any other industry in the United States. As shown in one of the charts, railroad earnings compare only with the median earnings of mechanical engineers engaged in teaching.

The survey and preparation of the report were directed by Professor Elliott Dunlap Smith of Yale University, and the statistical computation was directed by Professor Hudson B. Hastings, also of Yale University. The figures are based on 1930 earnings. At that time, the effects of the present depression had not seriously reached professional salaries, and only a few salary cuts had been made. Furthermore, the figures shown in the report do not refer to average, but to "median" earnings. To get the median earnings in any classification, the salaries of all the engineers in the classification are arranged in a column in order of amount. The total number of entries in the classification is then counted, and the salary figure in the middle of all the figures in the column is then taken as the median of the classification.

According to the report, the committee believes that median earnings give a truer picture than the average earnings, because the exceptional salaries of the few men at the top inflate the mathematical average far above the earnings of the typical man; while the median, which is determined by position in the earning scale, not by averaging of salaries, is uninfluenced by exceptional top salaries. Average earnings are usually much more than median earnings. For example, the report states that the average of 1930 professional earnings of mechanical engineers between the ages of 53 and 58 (the age of maximum earning power) was $10,200, which is more than 36 per cent greater than the median earnings at those ages, which was $7,600.



Comparison of 1930 median earnings of mechanical engineers by type of industry

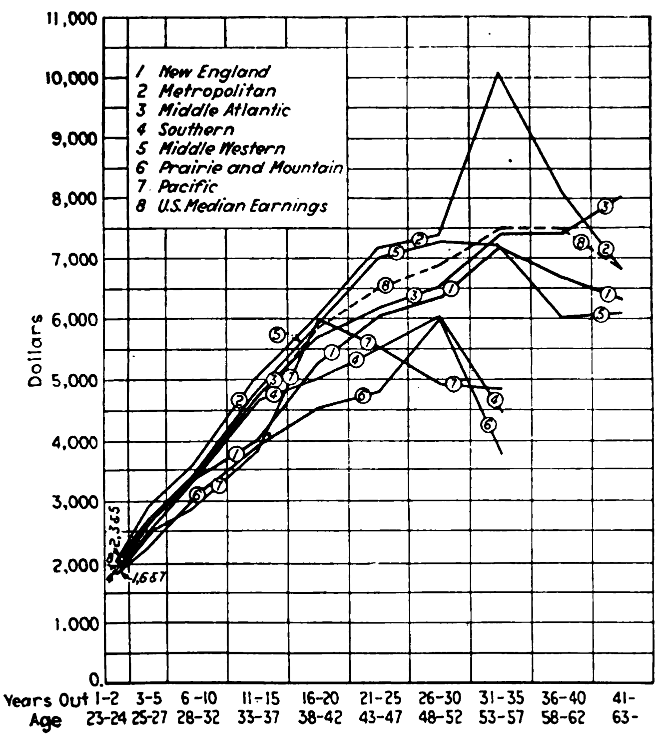
It is believed, the report states, that these figures are the most reliable that have been obtained as to engineering earnings. They are based on replies from over half of the membership of the American Society of Mechanical Engineers in the United States, which is approximately 18,000 members. A table in the report shows the distribution of engineers replying to the questionnaire by type of industry. Two per cent, or 127, of the questionnaires were returned by mechanical engineers employed in the railroad industry. The report states that, "although the number of returns from railroads is small, the results at all wage boundaries are so consistent as apparently to justify the inference that railroads pay below the median wage almost from the start."

Referring to the chart showing a comparison of the 1930 median earnings of mechanical engineers by type of industry, it will be noted that the median earnings for mechanical engineers in the railroad industry is about $2,000, with three years out of college or at 25 years of age, and increases to slightly over $3,000 after the engineer has been about 13 years out of college. The median curve then rises rapidly to slightly over $6,000, at which time the mechanical engineer employed by a railroad has been out of college about 24 years and is approximately 45 years of age. The median line drops to $5,400 at 50 years of age and increases again to $6,100 at 55 years of age.

Data Secured by Railroad Division Support Conclusions of Economic-Status Committee

The median earnings of mechanical engineers employed by the railroad industry and shown in the report of the A.S.M.E. Committee on the Economic Status of the Engineer are approximately the same as the median earnings shown in the report of the Railroad Division, A.S.M.E., Sub-committee on Professional Service. An abstract of the first report submitted by the Railroad Division committee, which was composed of mechanical engineers employed in the railroad and railway supply industries, was published in the February, 1927, page 93, issue of the *Railway*

Mechanical Engineer. A large part of the information with respect to earnings of mechanical engineers in the railroad industry, contained in the report by the Railroad Division, was obtained from a report of hearings before the Committee on Interstate Commerce, United States Senate, in 1921. The Senate Committee report only included salaries of $5,000 and over. Only a few of the salary figures given in the report were less than $5,000. The Railroad Division Sub-Committee on Professional Service did secure considerable data relative to the positions paying less than



Comparison of 1930 median earnings of mechanical engineers by geographical location

$5,000, but was unable to check enough of these salary figures against individual careers to plot what it considered to be a proper median curve for all positions in the mechanical departments of railroads. As pointed out in the report, which was presented at a meeting of the Railroad Division in New York on March 14, 1928, data pertaining to earnings below $5,000 were too inadequate to plot an accurate curve showing median earnings below that amount.

The median earnings of mechanical engineers employed by railroads up to and including the position of chief of motive power was reported by the Railroad Division to be around $2,000 shortly after graduation from college; $4,300 ten years after graduation; $6,000 twenty years after graduation, and $6,600 thirty years after graduation from technical school. A comparison of median earnings shown in the reports of the A.S.M.E. Committee on the Economic Status of the Engineer and the Railroad Division Sub-Committee on Professional Service, shows the data to be essentially in agreement, and supports the conclusions arrived at by the A.S.M.E. Committee.

Salaries Do Not Decline With Age

The report of the Committee on the Economic Status of the Engineer states that engineering earnings do not decline seriously with age. Median earnings of men over 63 years of age practically equal those of men 48 to 52 years old. The lower boundary of the top ten per cent is as high at 63 years of age as it was from 53 to 57. Even the upper boundary of the lowest ten per cent, where the peak is reached at from 43 to 47 years, does not decline after 63 to substantially less than it was at from 33 to 37.

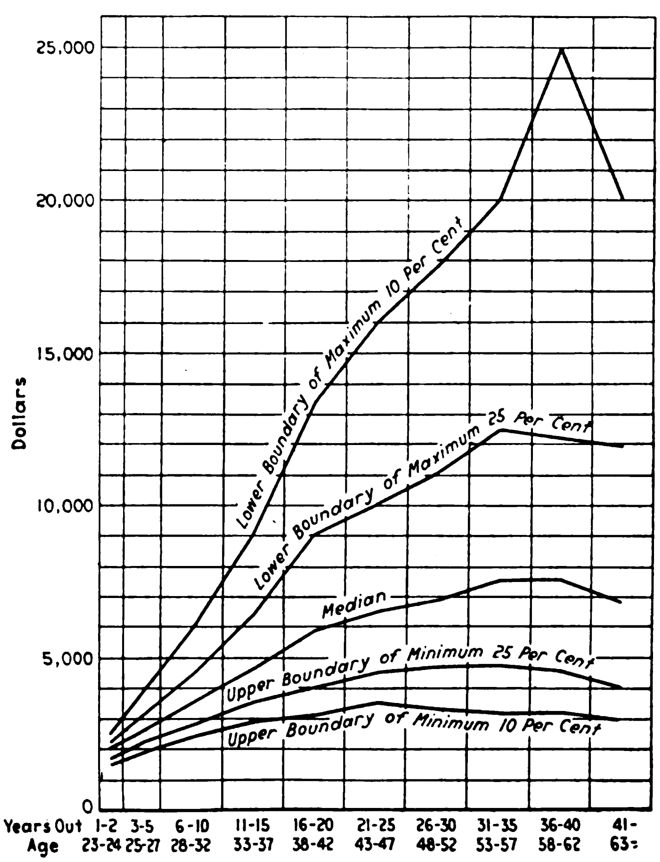
The maximum earnings at the upper boundary of men in the lowest ten per cent, it was pointed out, are earned by men between 43 and 47 years old; the maximum earnings at the lower boundary of the top ten per cent are earned by men from 58 to 62 years old. From the start, however, although the increase in dollars per year may be more, earnings at all salary boundaries generally increase at a slower ratio each successive year as men grow older, with a significant turning point in rate of increase between 35 and 40 years of age, as well as at the maximum.

Not only do salaries increase more rapidly in youth, but the rate of spread between the salaries of highly paid and low-paid men is greatest in early years.

What Engineers Earn on Different Types of Job

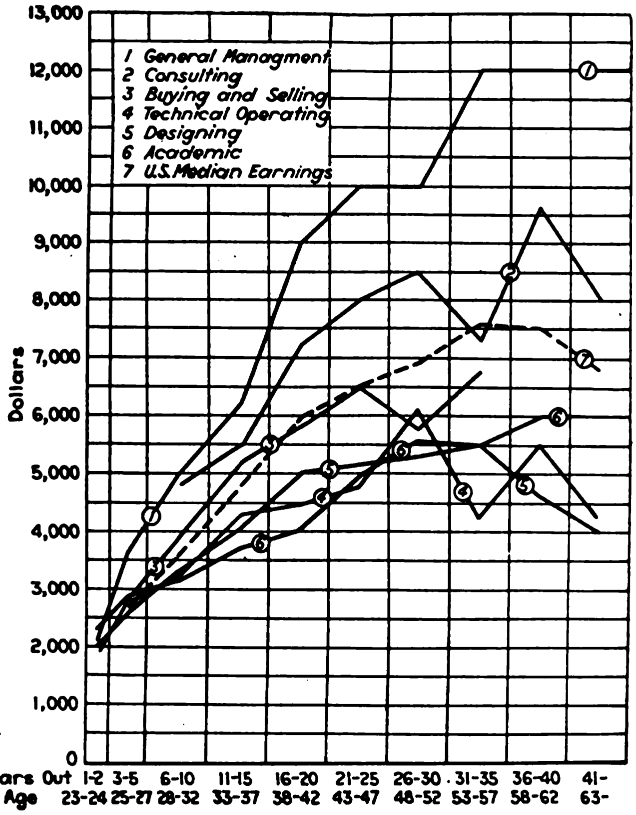
One of the charts gives comparative median earnings in the various sorts of work in which engineers engage. "Designing" includes all industrial research. "Technical operation" includes all maintenance, inspection, production control, and similar technical work relating to operation. "Consulting" as a type of job includes only actual consultants, and does not include consultant's employees as consulting as an industry does. "General management" includes all men in general executive work from assistant foremen up.

In classifying men by type of work an effort was made by the committee to include under each special type of work all the work of that character, regardless of whether the job could also be considered managerial,



Earnings of mechanical engineers during 1930 for the United States as a whole—Exclusive of salaries of teachers and federal employees

so that a man would not shift from one of the technical classifications to the general managerial classification merely because he progressed in his work to a position involving executive duties. For example, all men primarily concerned with industrial research or with the development of engineering design, even though they held such executive positions as chief engineer, or vice-president, were classified in the "designing" group. Similarly, all men primarily responsible for technical operation, including plant engineers and higher executives, were put in the "technical operating" group, regardless of the executive nature of their position. All persons directly related to sales or buying, from salesmen and buyers up through general purchasing agents, district managers, to vice-presidents in charge of sales and merchandising, were included in the selling and buying group. No one was put in the general management group unless his job was not only of a managerial character, but did not fall into any one of the special types of engineering work.



Comparison of 1930 median earnings of mechanical engineers by type of occupation

Teaching and those jobs where technical skill is the primary qualification ("technical operation" and "designing") are paid on about the same scale and throughout distinctly less than the median of the United States as a whole. Teaching shows a somewhat lower earning power than technical work between the ages of 30 and 40, and a distinctly higher earning power above 55. The median for buying and selling follows closely the median of the United States as a whole until the age of 45. After this age it falls distinctly below. Work which involves primarily either the capacity to handle independent businesses and to meet people as consultants, or the capacity to manage men and affairs as "general managers," is consistently well paid, general management especially soaring in earning power.

The relations between the median earnings of the different types of jobs also hold at other salary ranges, the differences becoming more emphatic, however, as higher wage levels are reached.

Managers, consultants, and teachers, show little falling off in old age, but designers, research men, and technical operating men, show an age drop after 50.

Not only is there this striking difference shown in the report between general management and consulting on the one hand, and design, research, and technical operation on the other, but there is a significant difference in earnings, especially among designers and research men, between those engineers doing technical work who have managerial duties and those who do not.

What an Engineer Can Do on Median Earnings

If median 1930 earnings are considered as the earnings of the typical engineer, and it is assumed in the report that the typical engineer marries at 26 years of age, and has two children at 30, the balance sheet of earnings and responsibilities on the 1930 basis will be about this: He will have about $2,700 to marry on; when his second child is born he will have about $3,500 with which to support his wife, his two children, and himself. When he is 45 and his two children are entering high school, he will have about $6,500 for his family income.

At the age of 50, 28 years after he himself was graduated from college, the committee estimates, he will have two children in college and earn about $7,000 a year. If he gives each child $1,000 a year for tuition and expenses, he will have $5,000 left to support his wife and himself. At sixty, with his children presumably self-supporting, he and his wife will have $7,500 a year to spend, but must look forward to a decline in earning power to $6,800 after sixty-three.

Where Earnings Are Highest

The New York Metropolitan district is reported as giving the highest median earnings at all ages below 63, but these are not substantially above earnings in the Middle Atlantic states except for men over 40, or the Middle West, except for men over 50. If the cost of living is taken into account there would probably be but little, if any, differential in favor of New York below that age, the report asserts. How much the sharp increase in earnings in New York City for men in the fifties is due to the calling to this city of leading men from other areas, it is impossible to determine.

In the Middle West, median earnings are slightly above the United States median until 50, after which there is a striking decline in earning power. The Middle Atlantic states, according to the report, fall behind the median of the United States at 40, but practically catch up at 55, and are well above the United States median at 65, although at the higher salary boundaries earnings remain low. Between 35 and 55 years of age, New England earnings are approximately $500 less than the median of the United States as a whole. After 60 they are nearly $800 less.

In the South, it is stated, young men under 35 earn well, but thereafter median salaries are consistently low, averaging over $1,000 below the United States median, but salaries at the higher boundaries are not below the country as a whole, even for men in their forties.

In the Prairie, Mountain, and Pacific states earnings are distinctly the lowest at all ages, except for salaries in the Pacific states for men between 38 and 42, who earn a little above the United States median, and salaries in the Prairie and Mountain states between 48 and 52, which equal those of the South.

A comparison of the data for type of job, shown in

(Concluded on page 448)

Krupp-Zoelly Turbine Locomotive Tested

By R. P. Wagner*

Tests in fast-passenger service show economies in fuel and water—Figure of 14.25 lb. of steam per drawbar horsepower-hour lowest ever obtained on a steam locomotive — Fuel consumption was 2.3 lb. per horsepower-hour at 37.5 m.p.h.

WHEN, in 1922, the German State Railways contemplated ordering its first steam-turbine locomotive thorough study was devoted to the merits of the several designs then in existence. It was agreed that no higher boiler pressure should be used than in ordinary practice in order to obtain a clear result from the exclusive utilization of condensation, namely: from the lower end of the temperature drop. This conclusion was conservative but reasonable, as at the time no one knew anything about economically working exhaust turbines, and because the economy of the steam turbine was known to be inferior to the piston engine at high pressures, but considerably superior to them at pressures around and below the atmosphere.

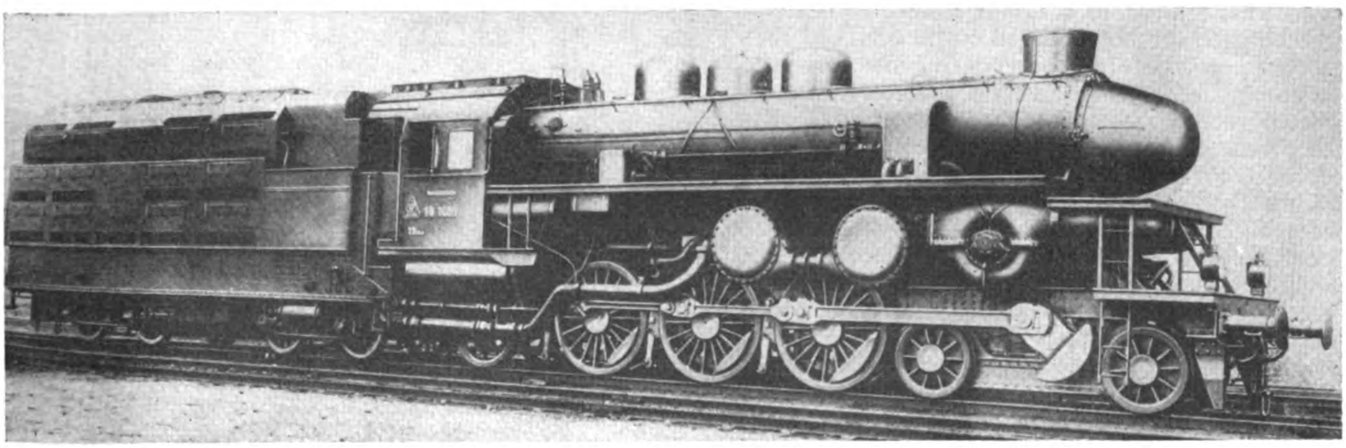
The necessity of condensation thus established, the novel elements of the locomotive were the turbine, the condenser and the air cooler for reclaiming the condenser water. The Ljungstrom system of condensing the steam by a dry stream of air meant a considerable saving in boiler water, as all the water of the engine circuit was condensed without any losses. But the condenser, due to the low specific heat of the air, required obviously an immense surface exposed to the air. Therefore more space and weight than was available on the locomotive proper. It also required, for forcing large quantities of air through the condenser, a fan of unusual capacity and of a greater steam consumption than seemed to befit any auxiliary engine. Moreover there was neither sufficient space on the engine nor weight allowance for the condenser. On the other hand, the placing of the condenser on the tender demanded imperatively that the turbine should be placed upon the same vehicle, as the pipe line for the exhaust steam leading from a turbine placed on the engine to the tender would have interfered badly with the vacuum and would have required a complicated flexible joint between the two, a joint hardly reliable in a vacuum line. For this reason Messrs. Ljungstrom arranged their turbine on the tender, next to the condenser. But this ingenious solution of the problem would hardly appeal to the railroad expert who does not care to see the locomotive pushed from the rear at high speed. This arrangement also included a flexible steam pipe under boiler pressure leading from the boiler to the main turbine on the tender.

The First Zoelly Turbine Locomotive

The design first brought forth by Dr. Zoelly, of Zurich, Switzerland,† opened another way towards a solution more palatable to a railroad man. The turbine was to be arranged on the locomotive in very much the same position as the ordinary locomotive cylinders, with water-cooled condensers closely attached to them. The condensers were, on the water side, supplied with ordinary feed water, which was taken from the tender and, after passing the condensers, was pumped back to the tender. This arrangement contained also a re-cooler for the cooling water, but it could easily be placed upon

* The author of this article is superintendent of the Locomotive Department of the German State Railways, Berlin.

† A description of the first Zoelly turbine-driven condensing locomotive appeared in the December, 1924, issue of the *Railway Mechanical Engineer*, Page 727. The Maffei turbine locomotive, No. 18-1002, which is being tested along with the Krupp-Zoelly locomotive, No. 18-1001, was described in the February, 1927, issue, page 78. Reports of the progress being made with the Krupp-Zoelly locomotive have appeared in a number of issues of the *Railway Mechanical Engineer* since 1924. This article, by Mr. Wagner, reports the progress and developments made on locomotive No. 18-1001 up to the present time.



Krupp-Zoelly turbine locomotive on the German State Railways

the tender and, as the condensing water would hardly be heated up to more than 140 deg. F., it could not deposit any scale in the condenser. Consequently raw water from the tender tank could be employed for the purpose.

In countries where water is scarce this cooling water could be re-cooled by air in a closed cooler like Ljungstroms', but this cooler would not have to contain a vacuum. This makes the design and maintenance of the many joints of such a cooler comparatively easy. In countries where water is abundant an open cooling system may be substituted for this type of closed air cooler, in which most of the heat is extracted from the water by evaporation. This process requires comparatively small fan capacity so that, roughly speaking, one quarter of the heat is absorbed by the air draft, whereas from 70 to 75 per cent of the quantity of water which is condensed in the clean-water circuit is evaporated and absorbs three-quarters of the waste heat.

Alterations to the Krupp-Zoelly Locomotive

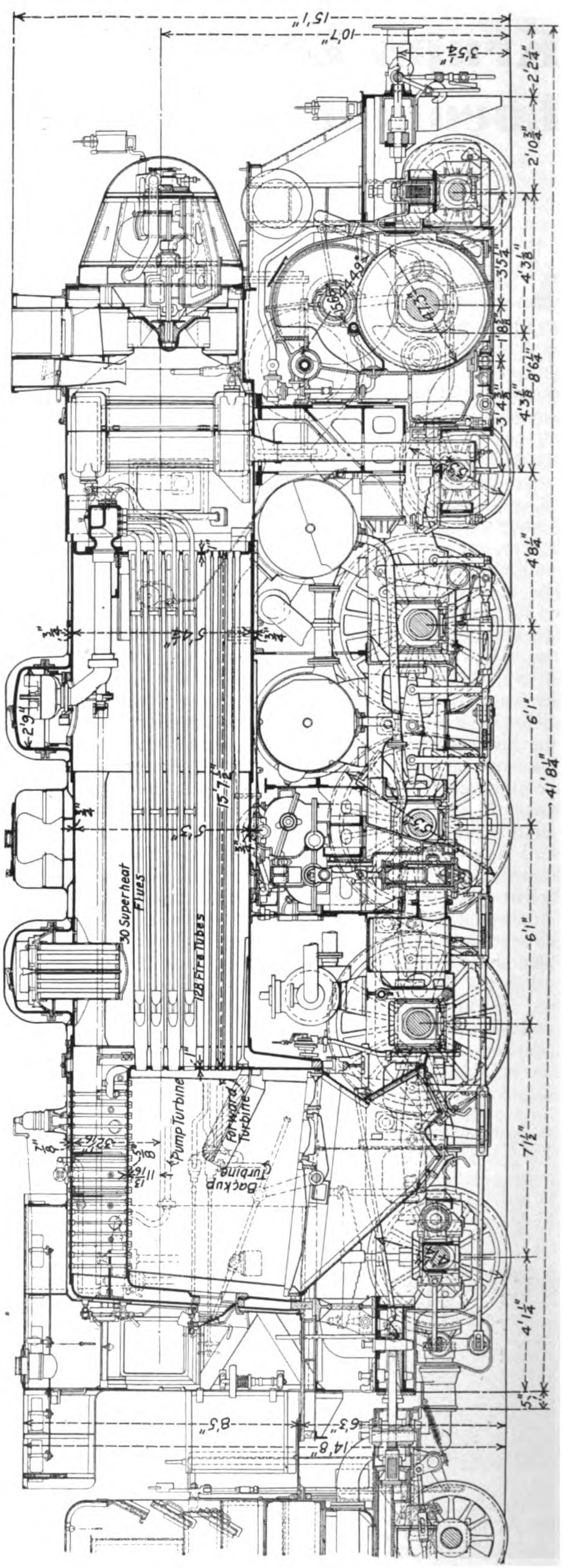
Because of its obvious advantages this system was chosen for the first test and a high-speed passenger locomotive of 2,000 hp. capacity was ordered from Fried. Krupp Aktiengesellschaft, the German licensees of the Zoelly system. It was finished for the Seddin Railway Exposition, which was held in October, 1924, and made some preliminary trips over the road. After that it was sent back to Krupps' and was there subjected to thorough stationary tests of the boiler and turbine, in which the side rods were disconnected and the jack shaft was connected to electric generators.

The result of these tests was that the system in itself proved entirely satisfactory. Besides some minor details, three parts of the system required major alterations to attain the economical limit for acceptance. These parts were the economizer, the turbine for backward motion and the water cooler on the tender.

The economizer, in which the boiler feed water was to be heated by combustion gases, was formerly placed crosswise the engine under the barrel of the boiler. The combustion gases, after passing the flues, were forced back from the front end through a square channel and, after passing the economizer, were returned to the front end and to the suction fan through another channel. This arrangement proved unsatisfactory and was replaced by an economizer in the front end shaped somewhat similar to a Coffin feedwater heater.

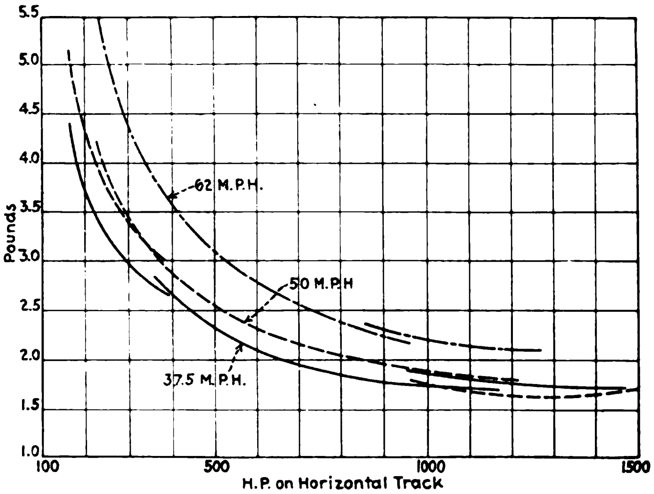
The back turbine mounted on the shaft of the forward turbine and acting during the forward motion somewhat like a rotary compressor moving in vacuum, consumed more power than anticipated. The rule for any future design deduced from the tests was that either the number of disks of this turbine (whose economy is not over-important) should be reduced to one or two or that instead of a back turbine a reversing gear should be provided. In the case of the existing locomotive it was resolved to retain the back turbine in its initial shape and to shut off its exhaust opening by a hand-operated shutter consisting of half-moon blades made of sheet metal. This alteration proved reasonably satisfactory.

The tender formerly had a spray system in which the drops of water fell a considerable dis-



Elevation of the Krupp-Zoelly turbine locomotive

tance to afford sufficient contact with the air blown upwards. Considerable water was entrained by the air and caused a shower to fall on the coaches behind the locomotive. Another sprinkler was therefore employed, in which the water drips into layers of Raschig rings arranged on perforated trays. These rings are designed to provide a large surface to the water and air. Scarcely any water is entrained with the present system, as it



Coal consumption per horsepower-hour at the drawbar

clings to the ample surfaces provided. This alteration did away with most of the trouble.

On completion of these changes in construction, the locomotive was subjected to thorough road tests by the testing department of the German State Railways, which is in possession of several complete dynamometer cars. These tests proved that the guaranteed fuel limit was attained. Moreover they proved that this turbine locomotive is at present the most economical locomotive on the system, whatever may be said about the complications necessary to obtain the result. The locomotive was formally accepted and assigned to the Essen division, where it hauls fast passenger trains between Hanover and Aix-la-Chapelle.

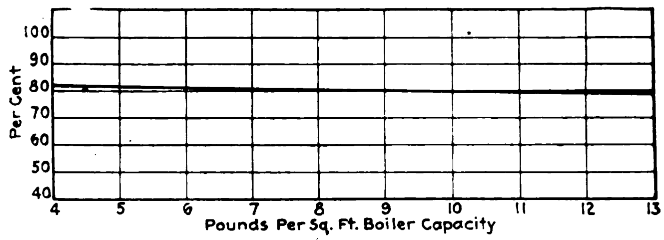
Features of Construction and Performance

The Krupp-Zoelly locomotive is a Pacific type with a permissible weight on each wheel of about 22,000 lb. The boiler is similar to the ordinary German locomotive boiler but for two exceptions:

First, the grate area and the heating surface seem smaller than suitable for a boiler of 2,000 hp.; the anticipated saving of never less than from 10 to 12 per cent of the heat accounts for this fact.

Second, the boiler is not equipped with a feed dome as is German practice, because the feed water makes a closed circuit and is pure when it enters the boiler. Instead of the feed dome another steam dome is arranged on the back course which serves an unusual purpose. As it would be wasteful to use water from the closed circuit for heating purposes a small boiler holding raw water for train heating is placed in this dome and exposed to the steam of the main boiler. The drop in temperature is sufficient to maintain in the heating system the regulation pressure of 70 lb. per sq. in. The small quantity of pure water required for making up losses in the closed circuit (for leakages, fan turbine and safety valves blowing off, altogether from 3 to 5 per cent), is also taken from this boiler after being purified of scale-forming material.

The front end is essentially different from conven-

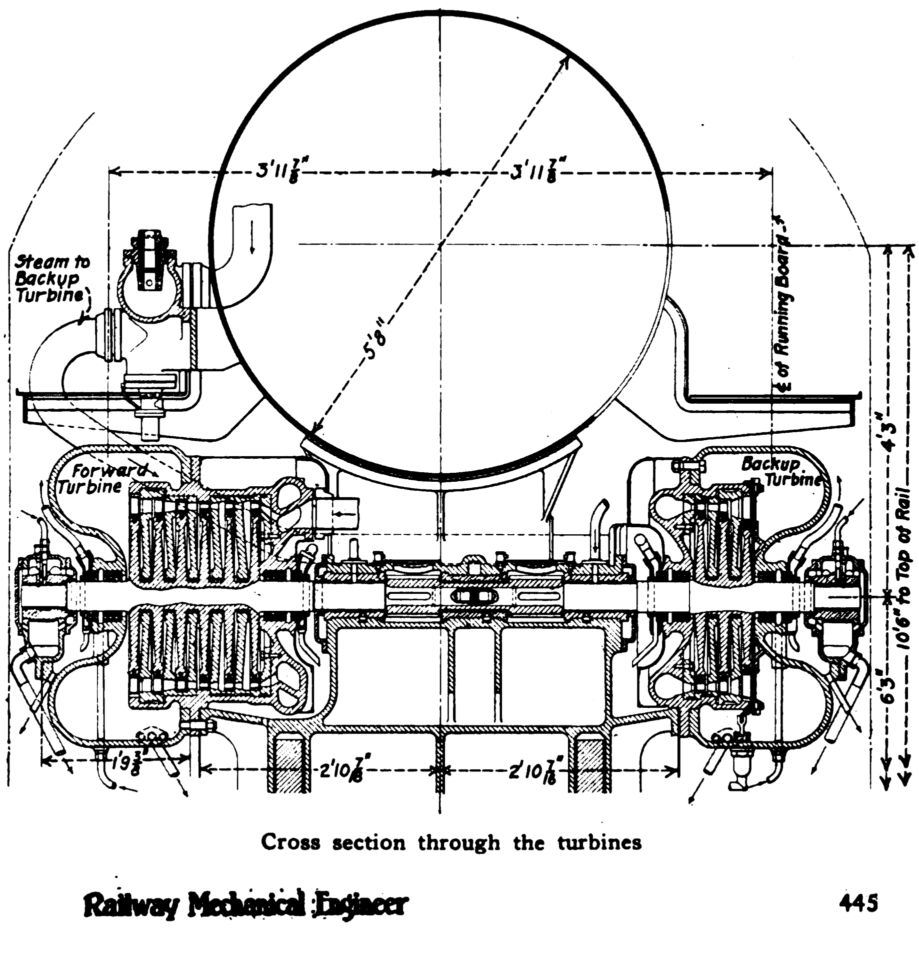


Boiler efficiency

tional design. The ring-shaped economizer is placed ahead of the superheater header and the cylindrical opening in its center is closed by means of a removable diaphragm, so that the gases are forced through the ring chamber, where they hit against the water pipes.

After passing the economizer, the gases are sucked into a fan driven by a steam turbine and discharged through the fore part of the stack. Another stack, smaller in diameter, is placed behind this stack, through which the gases are discharged by a blower when the locomotive is standing and the fan is not running. At other times this stack is closed by a diaphragm. The fan is inserted in the front door and swings out with it.

The other auxiliary on the engine serves chiefly the



Cross section through the turbines

boiler and the condenser. A geared steam turbine is arranged between the frames below the back course of the boiler. It drives a two-stage boiler feed pump, a rotary pump for the circulation of the cooling water for the condenser, the air compressor and the small pump which delivers purified water into the closed circuit. Both feed pumps have been designed as piston pumps, as in the case of a leaky boiler check, a rotary pump would allow boiler steam or water to enter the vacuum reservoir.

Dimensions, Weights, and Proportions of the Krupp-Zoelly Turbine 4-6-2 Type Locomotive

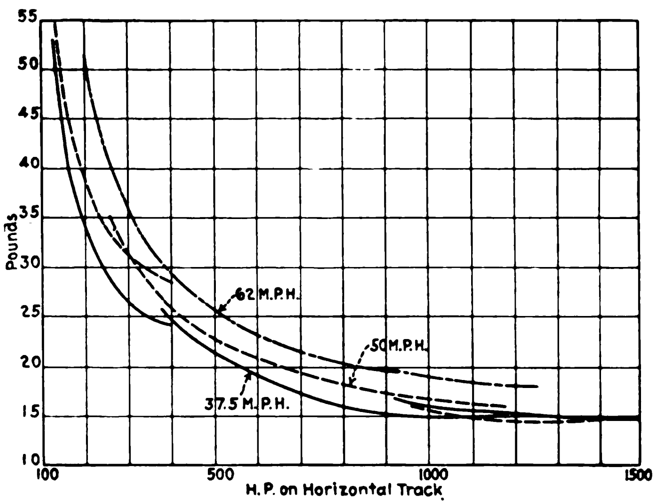
Railroad	German State Railways
Builder	Fried Krupp Aktiengesellschaft
Service	Experimental passenger
Type of locomotive	4-6-2
Road number	18-1001
Maximum speed	68 m.p.h.
Weights in working order:	
On drivers	130,900 lb.
Total engine	247,500 lb.
Tender	155,000 lb.
Total engine and tender	402,500 lb.
Wheel bases:	
Rigid	12 ft. 2 in.
Total engine	32 ft. 6 in.
Wheels, diameter outside tires:	
Driving	65 in.
Trailing truck	49¼ in.
Front truck	39¼ in.
Boiler:	
Steam pressure	213.3 lb.
Fuel, kind	Soft coal
Flues, number and diameter	30—4-15/16 in. and 5¼ in.
Tubes, number and diameter	128—1-3/16 in. and 1½ in.
Grate area	33.4 sq. ft.
Heating surfaces:	
Evaporative	1,668.5 sq. ft.
Superheating	710.4 sq. ft.
Combined superheat and evaporative	2,378.9 sq. ft.
Turbine and condenser:	
Revolutions of main turbine	8,000 r.p.m.
Ratio of gear between turbine and jack shaft	1:24.3
Condenser surface	2,368.15 sq. ft.
Tender:	
Water capacity	4,500 gal.
Fuel capacity	6.5 tons
Wheels, diameter outside tires	39⅜ in.
Tractive force	27,500 lb.
Weight proportions:	
Weight on drivers ÷ total engine weight, per cent	53
Weight on drivers ÷ tractive force	4.76
Total weight engine ÷ comb. heat surface	104.2
Boiler proportions:	
Tractive force ÷ comb. heat. surface	11.68
Tractive force × diam. drivers ÷ comb. heating surface	758
Combined heating surface ÷ grate area	71.2

The main turbine and its gear occupies all the space available underneath the front end. This equipment extends down between the frames in such a manner as to compel the designer to displace all vital parts of the engine truck. As a turbine gear casing could not be designed strong enough to withstand all the stresses to which the cylinder saddle is subjected, the gear casing has been placed as far forward as possible with an independent steel casting closely behind, the latter forming the front-end boiler support or saddle. To remove all outside stresses from the gear casing the latter is suspended in both frames by side pinions placed immediately back of the jack shaft. During forward motion, the reaction of the gear presses the upper part of the casing against the saddle piece, to which it is bolted to withstand the reverse stress during backward motion. The turbine casing is partly cast in one piece with the gear casing but it is so divided as to keep the steam away from the gear.

The gear is made of hard nickel-chromium steel with small and close-pitched teeth milled after Krupps' special manufacturing process. It seems remarkable that in a gear of this capacity the ordinary noise, which means gradual wear and destruction, has been reduced to a fine humming tone. Force-feed lubrication for all bearings and for the gearing, which is supplied by an independent pump makes a safe but complicated detail as compared with ordinary cylinder lubrication.

The inside of the engine truck was to be kept entirely free for the lower part of the gear casing. The center pin was shifted backwards and fastened in the casing. The truck frame has been designed trough-shaped all around the latter. The rear set of wheels is equipped with two independent bearing springs, whereas on the front wheels, to obtain a three point suspension, a single bearing spring is arranged crosswise. Although all theoretical requirements of a leading truck have been met, it appears to be heavily inconvenienced by the position and size of the gear, and even a minor derailment would be likely to prove fatal to the gear casing.

Both main turbines are mounted on one shaft. The forward turbine, which is placed at the right-hand side of the locomotive, is a six-stage turbine of the Zoelly type. The first disk is fed by two sets of nozzles designed for a feed of, respectively, 6,700 lb. and 13,400 lb. of steam per hour. By bringing both sets of nozzles into action at a time the weight on the drivers can be fully utilized in starting or on steep grades. The boiler is sufficiently dimensioned to produce 20,000 lb. of steam. All stages of power between these three nozzle positions (which may be compared to three positions of cut-off) have to be reached by throttling the steam pressure in the dry pipe, a process still open to improvement.



Steam consumption per horsepower-hour at the drawbar

The back-up turbine is located on the left side. It is a three-stage turbine with only one set of nozzles, as backward motion is comparatively rare. The exhaust chambers of both turbines are connected by a wide vacuum pipe in front and have, on both sides, a direct short exhaust into the front condensers, as shown in the drawing on page 445.

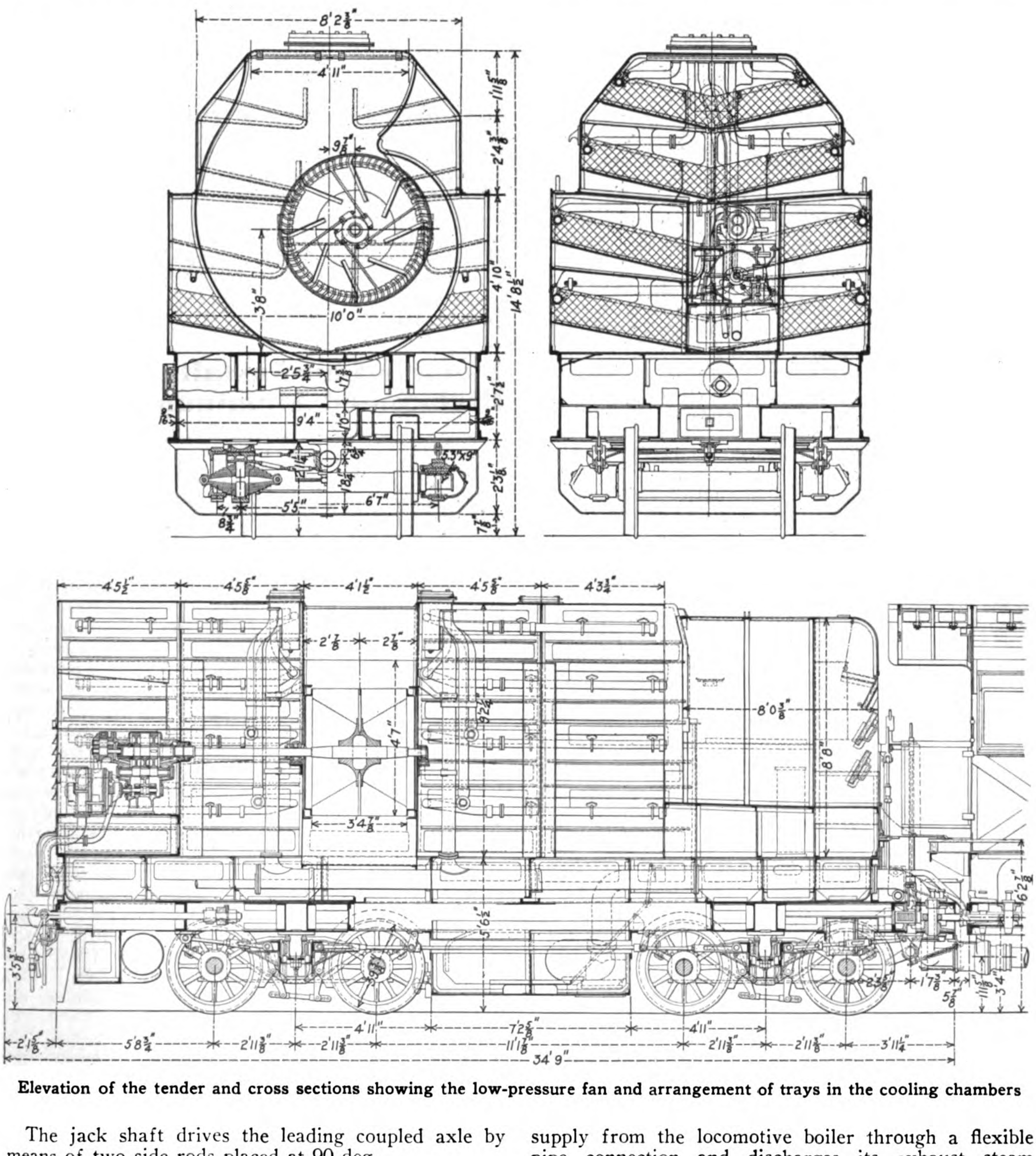
Both water-cooled condensers are arranged crosswise of the locomotive between the boiler and frames. The front condenser is just ahead of the leading coupled wheels, the rear one is located between the leading and the second pair of drivers. The latter unit, on the steam side, is not directly connected with the turbines, so that it merely receives the overflow of the front condenser.

All other parts of the locomotive proper are but slightly different from ordinary locomotive practice. The frames are of the bar type, made, according to

German practice, of rolled 4-in. plates and machined throughout. The coupled wheels are remarkable for the smallness of their diameter, 65-in., as compared with maximum speed 68 m. p. h. This diameter was admissible as no reciprocating parts are included in the system. On the other hand the momentum of the revolving parts, especially because of the turbine and gear wheels, was increased to such an extent that the weight on the trailer wheels had to be utilized for braking purposes, which is otherwise not German custom.

used for train heating and for feeding the closed circuit. As this consumption should not be more than three quarters of the water consumption of an ordinary locomotive a tank holding 4,500 gal. was considered sufficient. The fuel supply is contained in a closed bunker and amounts to 6.5 tons of coal. The larger portion of the tender is occupied by raw water cooling equipment.

The center of the cooler is a powerful low-pressure fan with horizontal shaft. This fan is driven by a geared steam turbine, which receives its live steam



Elevation of the tender and cross sections showing the low-pressure fan and arrangement of trays in the cooling chambers

The jack shaft drives the leading coupled axle by means of two side rods placed at 90 deg.

The tender, which is heavier than ordinary tenders, is carried on two four-wheel trucks and is entirely enclosed. The raw water supply is partly evaporated, part

supply from the locomotive boiler through a flexible pipe connection and discharges its exhaust steam through a similar pipe into the feed-water header.

The fan draws air through the cooling chambers which are provided with four trays, one above the

other. These trays have perforated bottoms, through which the air is drawn into the fan. Each tray is filled with a layer of Raschig rings. These patent rings are an ingenious device for providing large surfaces without requiring much space. They consist of pipe cuttings, whose length is equal to their diameter. When arranged loosely in a layer, they provide many irregular air channels, which deflect the air and bring it in close contact with all inside- and outside-ring surfaces. These surfaces are thoroughly wetted by the warm water sprayed into the ring layer from a perforated discharge pipe which is placed immediately above. The air, saturated with moisture, is delivered to atmosphere through an opening in the roof of the tender.

All of the tests made with this locomotive were made on the road. The figures for steam and fuel consumption per drawbar horsepower-hour were influenced slightly by the varying air resistance. At a speed of 37.5 m.p.h. the steam consumption of the locomotive was 22 lb. at 500 hp. This consumption decreased to 16 lb. when the locomotive was exerting 1,000 hp. at the drawbar. At a speed of 50 m.p.h. the steam consumption at 500 hp. was 23.5 lb. which was decreased to 18 lb. at 1,000 hp. At 62 m.p.h. the locomotive used 26 lb. of steam at 500 hp. and 21 lb. at 1,000 hp. The boiler efficiency of 81 per cent showed the favorable influence of using pure water on heat transmission. The efficiency of 81 per cent was obtained at one-third of the normal load, and the efficiency curve dropped at a remarkably slow rate to 79 per cent at full load. The general trend of boiler efficiency, with the draft produced by a fan, is similar to that of the boiler of a reciprocating locomotive, and proves that the combustion and boiler efficiency are not influenced by the number and nature of the impulses from the exhause nozzle, but depend solely on the rate of combustion and the velocity of the combustion gases.

Curves showing the steam consumption at 37.5 m.p.h., 50 m.p.h. and 62 m.p.h. were somewhat unusual owing to the fact that steam is admitted to the turbine either through the small set of nozzles, through the large set, or through both sets of nozzles. The figure of 14.25 lb. of steam per drawbar horsepower-hour is the lowest ever obtained on a steam locomotive. The fuel consumption per horsepower-hour at 37.5 m.p.h. was 2.3 lb. at 500 hp. at the drawbar and 1.7 lb. at 1,000 hp. At a speed of 50 m.p.h. the locomotive consumed 2.6 lb. of coal at 500 hp. which decreased to 1.8 at 1,000 hp. At 62 m.p.h. in exerting 500 hp. at the drawbar the coal consumption was 3.1 lb. decreasing to 2.25 lb. at 1,000 hp.

A.S.M.E. Reports Railroads Pay Low Salaries

(Continued from page 442)

the report, with those of different industries indicates that while academic institutions pay less than almost any other class of employers, the earnings of teachers compare favorably with the earnings in the technical branches of engineering. It also indicates that the differences between types of industries are relatively small compared with the differences between types of work. Apart from teaching and railroads, it is pointed out, it makes relatively little difference what industry a man goes into. There is little question that the highest salaries in the design and technical operation groups themselves, the report states, are received by men whose work is largely of an executive nature, such as vice-president in charge of design and chief engineers.

The survey committee concluded that a good education is "worth while," stating that, apart from railroads and academic institutions, the differences between industries as regards salary opportunities are not great at most ages.

The differences in earning power between men whose work is exclusively technical and those who combine with their technical ability the capacity to handle independent businesses or to manage men or affairs, are great—so great as to indicate the importance of most engineers' seeking to develop themselves in this respect, and of engineering schools bending their curricula somewhat toward this end.

The report was signed by Conrad N. Lauer, (chairman) president, Philadelphia Gas Works, Philadelphia, Pa.; C. F. Hirshfeld, chief of the research department, Detroit Edison Company, Detroit, Mich.; Dexter S. Kimball, dean of the College of Engineering, Cornell University; Henry B. Oatley, vice-president in charge of engineering, Superheater Company, New York; Col. William A. Starrett, president, Starrett Corporation, New York; Herbert L. Whittemore, chief of the Engineering Mechanics Section, Bureau of Standards, Washington, D. C.; William Elgin Wickenden, president of the Case School of Applied Science, Cleveland, Ohio, and James M. Todd, consulting engineer, New Orleans, La.

Electric Line Installs High-Speed Aluminum Cars

(Continued from page 439)

sheets with proper baffle plates, pipe connections, etc. The tank is welded, as are the baffle plates and pipe connections. Continuous basket racks are located on each side of the car, being made of aluminum castings and tubing. The aluminum pressings were all made without heating the sheets. The pressings aided in eliminating rivets and welding. The largest item of welding was the joints between the side posts and end posts and the window sills, welded by the metallic-arc process.

Equipment supports under the car are all-aluminum forgings or pressings, formed cold. A pilot is provided under the front end of the car, which is made of aluminum angles and tubing. The angles, made of strong-aluminum alloy, contain several sharp bends which required practically a forging operation. This was conducted at about 300 to 400 deg. F., in order not to affect the physical properties of the material. The angles were heated in this instance in a special furnace out of direct contact with the frame to prevent overheating and oxidation. Tubing used in the pilots was made of soft aluminum and worked cold. In connection with this light forging work, another notable characteristic of aluminum was observed in its much greater heat-conductivity than steel, this characteristic being helpful in rapidly dissipating heat from the application of hot steel rivets so that the heat has a purely local effect, if any, on the physical properties of the strong-aluminum alloys.

Adding Insult to Injury.—Just how quiet things are these days along the railroads is indicated by a report from Hobart, Ind., that a ring-necked pheasant has located her nest within a few feet of the Pennsylvania main line at that point, and another from Augusta, N. J., to the effect that a robin has built a nest and raised a family in the air-brake compressor of one of the Lehigh & New England's gasoline locomotives. We have been aware that the railroads are not getting as much business as they would like to have, but it is discouraging to know that they are so idle that birds are building nests on them.

Cutting Costs In the Coach Yard

The installation of modern equipment for washing cars and making repairs will pay for itself in a short time

THE coach yard is too often looked upon by mechanical officers as a sort of necessary evil and when the budgets are made up for improvements this part of the car department usually gets nothing at all or is obliged to get along with home-made equipment that is of little assistance in performing the work. The very nature of the work demanded of the coach yard is such that it should be worth while to install time saving equipment in order to speed up the work at important terminals. Consideration is rarely given to the fact that modern facilities especially designed for coach yard use will not only save a lot of time but will result in substantial economies in operation and maintenance as well.

With the idea of finding out just what could be accomplished along these lines a survey was recently made of the conditions existing in a number of coach yards in different parts of the country and it may be said that there has been practically no effort made to modernize the operation of this phase of car department work. In order to give some idea of the possibilities of utilizing modern equipment, examples are presented in this article of the methods and facilities used in a coach yard handling an average of 125 cars a day. Cost figures are included to show the cost of performing the work by the now obsolete methods as compared with the lower costs with modern facilities. At no one point did actual installations provide a complete example of all the facilities mentioned in this article so that it has been necessary, for purposes of comparison, to take the figures under the older methods and estimate the cost of doing the work in the same yard with the new equipment using actual known costs obtained from railroad coach yards in which such new equipment has been installed and operating for some time.

In a coach yard handling 125 cars daily the distribution of the cars according to type is as follows:

Type	No. of cars	Percentage
Pullman	39	31
Diners	10	8
Mail	11	9
Baggage and Express	16	13
Coaches	49	39
Totals	125	100

Passenger Car Repairs

Ordinarily the principal jobs that have to be performed in the normal operation of making running repairs to passenger cars are those of changing wheels, adjusting the height of couplers by shimming the springs and center plates, changing bearings and bearing wedges and numerous other miscellaneous items on the trucks and underframe where it is necessary to raise the body of the car. In most coach yards, hand-operated jacks are used at the present time to raise and lower the cars and, in the majority of instances, inadequate home-made drop-pit jacks are used for removing wheels. In order to handle the above mentioned repairs on 125 cars a day (with the men working on two shifts) the daily labor costs, with the old type of equipment, amounted in one case to $129.60 or an average of $1.04 a car. This average cost per car, it might be explained, is arrived at by taking the entire amount spent for work of this type on all cars in any one day, week or month and dividing this total amount by the total number of cars which received any repairs of this nature during the same period. The use of modern air-motor-driven hoists and electric drop tables has materially simplified the task of doing work of this kind, and, in one yard, an investment of $5,100 in new equipment made it possible to reduce the daily labor cost for this kind of work to a figure of $90.72, or 74.69 cents per car. It might be added that these latter figures include interest at 6 per cent, depreciation at 10 per cent and a reasonable allowance for maintenance on the new equipment. On the basis of the above figures, the annual cost for repairing cars under the old method is $47,450 while, with the new equipment, it would be $34,077, or a saving of $13,373 a year.

The Cost of Cleaning Cars

In practically all the coach yards of this country, large or small, the work of cleaning both the exteriors and interiors of all types of passenger train cars is a job requiring a maximum of manual labor. Within the past few years car washing and scrubbing machines have been designed and installed at some coach yards which make it possible to take a train of from 10 to 15 cars as they are received from the passenger station and run them through the washing and scrubbing machines. These machines make it possible to keep the painted surfaces of the cars in much better condition than when the cars are scrubbed and washed by hand. Cars which have been through the washing and scrubbing machine several times and which are regularly serviced by this newer method of cleaning present a much neater appearance in trains than those which are cleaned by the most careful of hand methods. In one yard which handles about 125 cars a day, the average labor cost of cleaning the exteriors of cars (exclusive of trucks) is 70.8 cents per car plus a charge of 8.2 cents per car for supplies, making a total cost of 79.0 cents per car. At the rate of 125 cars a day, it is necessary to clean 45,625 cars a year at a total cost of $37,044. The installation of a modern mechanical car washing and scrubbing machine, involving an investment of approximately $8,000, would reduce the average cost per car cleaned to 46.66 cents, or an annual total of $21,289. This latter figure under the machine methods of cleaning indicates that the installation of the machines results in a saving of $15,755. Into the cost of machine cleaning is figured interest, depreciation and

maintenance on the washing machine, the necessary supplies, power and water as well as the time required for a switching crew to handle the cars through the machine.

There is a possibility that in some instances an electric car puller could be used more effectively to handle the cars through the washing machine, thereby making a substantial reduction in the cost per car. This would, of course, depend upon the layout of the coach yard. Where the yard is so situated and the washing machine so located that the cars can be run through the machine as they enter the yard without additional handling from the station it would, of course, be more economical to make use of the switching locomotive. The estimated cost of moving cars with a car puller, including interest, depreciation, maintenance on the machine and attendant labor required, is approximately 6.5 cents per car as compared with 14 cents for moving with a locomotive.

Interior Cleaning

Where cars are cleaned by hand methods, a study of the costs in a yard handling 125 cars a day indicates that the actual cost for 86 cars (the interiors of Pullman cars are cleaned by Pullman Company forces) is 42.17 cents per car. These costs include all hand sweeping, dusting, brushing, beating the dust out of the seats and blowing out the interior of the cars with air. It also includes the cleaning of the carpets, plush seats and seat backs with a home-made air suction outfit. On the basis of handling 86 cars a day, the annual cost of cleaning cars by hand methods amounts to $13,237.

On one road which has recently changed over to a complete vacuum cleaning system for handling this work, it is reported that the costs per car have been reduced 22 per cent. The coach yard is equipped with one four-outlet portable electric vacuum cleaning machine fitted with special nozzles and brushes for cleaning mouldings, side walls, floors, ceilings, curtains, carpets and seat plush. The investment required for the installation of such a vacuum cleaning system is approximately $3,000. On the basis of 86 cars a day, at 22 per cent saving, the cost of car cleaning would be reduced to 32.89 cents per car or $10,624 a year, indicating an annual saving of $2,613.

Icing Passenger Cars

Another job in the coach yard on which modern equipment can undoubtedly save money is that of icing passenger cars. Under the present system in use in most coach yards, ice is loaded in a small four-wheel ice truck having a capacity of about 500 to 1,000 lb. (enough to ice 10 to 16 cars). These trucks are pulled by hand from car to car while the cars are being iced. Ordinarily, two men handle a truck and fill the individual ice buckets which are placed on the car platforms for the inside men to handle to the coolers. Two men can average about 15 cars an hour, including the time it takes to go to the ice storage and fill the trucks. At current wage scales, this cost will figure out to about 8.53 cents per car. If an electric truck, involving an investment of approximately $2,200 is used for this work, the truck can handle three trailers of ice at one time, which is sufficient for the icing of from 30 to 50 cars. This eliminates two trips out of three to the ice storage for refilling the trucks—each of which usually consumes about 20 minutes when the work is done by hand. Owing to the greater speed at which the electric truck can operate, a time-saving of approximately 20 minutes can be added to the 40 minutes saved by eliminating the trips for refilling the trucks, thereby making a total saving of approximately one-third of the time required. With the electric truck, cars can be iced at the rate of 20 an hour and the cost, including labor, interest and depreciation on truck investment, and truck operation and maintenance will be 5.4 cents a car.

The savings by the electric truck method in a yard handling 125 cars a day, an average of 109 of which are iced, would amount to 3.13 cents per car or an annual saving of $1,245 a year.

After considering the potentialities of a modernization program from a dollars and cents standpoint, it is evident that many of the so-called non-revenue departments on a railroad can make a real contribution toward the reduction of operating expenses if given the facilities. In Table I is shown a summary of the costs, investment necessary and the savings as outlined in this article. Modern industrial plants during the past few years have been inclined to replace obsolete machinery where that equipment will pay for itself within a reasonable length of time. The railroads have made many economy producing investments which would not pay for themselves in less than four years, yet, the summary of the savings outlined in Table I indicates that it is possible to install in a coach yard modern equipment now available which will result in sufficient savings in maintenance expenses to pay for the new equipment involved in less than seven months.

Table I—Summary of Costs, Investment and Savings

Items	Old methods	New methods	Investment	Savings
Car Repairs	$47,450	$34,077	$5,100	$13,373
Exterior Cleaning	37,044	21,289	8,000	15,755
Interior Cleaning	13,237	10,624	3,000	2,613
Icing Cars	3,393	2,148	2,200	1,245
Totals	$101,124	$68,138	$18,300	$32,986

New Diesel Locomotives in Great Britain.—Three new Diesel-electric locomotives recently completed in England are being tested on British railways according to reports received by the United States Department of Commerce. Power for the motors is supplied by generating units driven by Diesel engines and it is estimated that under normal conditions they will run for nine hours on one ton of heavy oil.

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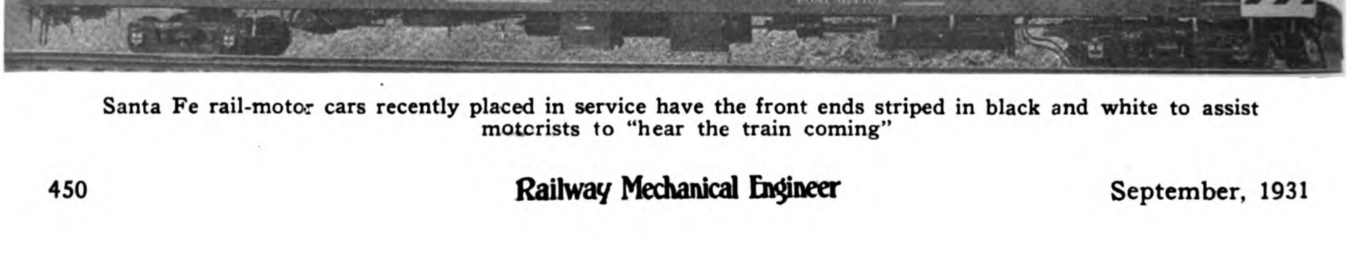


Santa Fe rail-motor cars recently placed in service have the front ends striped in black and white to assist motorists to "hear the train coming"

Freight Locomotive Designed For Bad-Water Territory

Canadian National builds a sample 2-8-2 type locomotive for test in fast-freight and tonnage service on the Western Region—Designed to overcome difficulties experienced with sludge and boiler sediment being carried over into the superheater units and cylinders

OPERATING conditions are encountered on the Western Region of the Canadian National in the prairie provinces which render locomotive maintenance costly, due primarily to the poor quality of feedwater available. When new freight power was being considered for this region, it was decided to build a sample locomotive in which features were embodied that would tend to relieve these conditions.

Most of the difficulties experienced have been due to sludge and boiler sediment being carried over by the steam flow into the superheater units and cylinders, and by the burning out of firebox sheets.

A locomotive, to meet the above conditions, must provide some method of collecting and conveying steam to the cylinders different from that usually employed, must have a relatively slow rate of combustion, high boiler capacity and steam distribution of a nature such that full capacity can be developed without unduly forcing the machine as a whole.

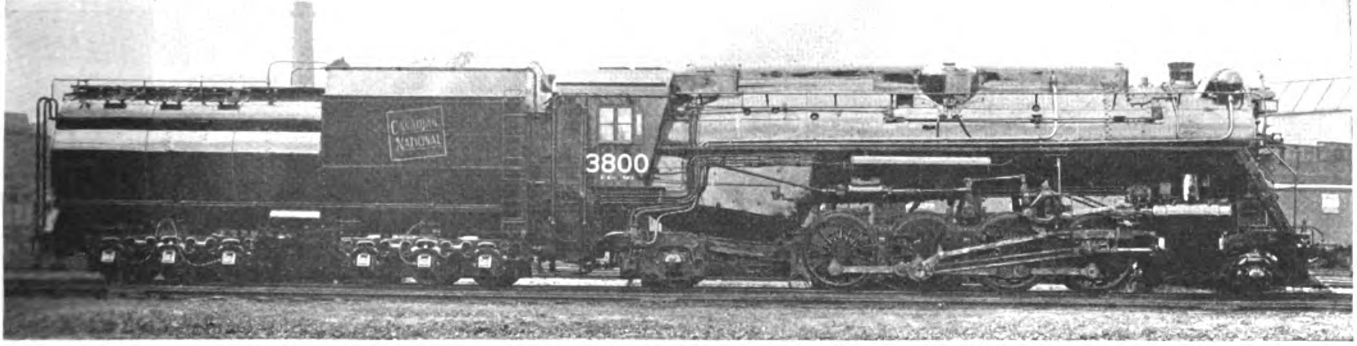
With these conditions in view, the company designed and built at its Point St. Charles shops, Montreal, Que., locomotive No. 3800, Class S-4-a, and, on completion in the early fall of 1930, placed it in service on the Central Region for observation and test between Danforth, Ont., and Sarnia, Ont., in fast-freight service and, later, between Danforth and Fort Erie, Ont., in heavy coal service. Under both classes of operation the locomotive has demonstrated its ability to perform in a satisfactory manner and considerable valuable experience is being gained for incorporation in further designs at a future date. Several minor alterations have been made to the original design as the result of the preliminary test runs.

The No. 3800 exerts a tractive force of 56,200 lb. It has 24-in. by 30-in. cylinders and operates at a boiler pressure of 265 lb. The driving wheels are 63 in. in diameter. The locomotive weighs 337,200 lb., of which 237,000 lb. is carried on the drivers.

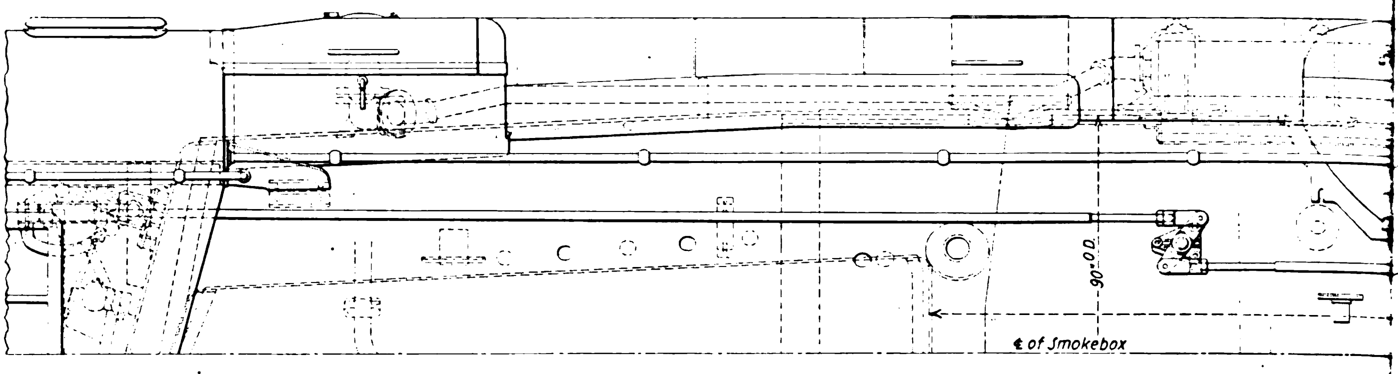
Boiler Construction

In accordance with the requirements referred to in the preceding paragraphs, the dome and inside dry pipe have been omitted from the boiler and an outside dry pipe of somewhat novel design introduced in their stead. On the top center line of the boiler at suitable intervals three 5½-in. holes are cut to provide an outlet for the steam. Over these openings are riveted cast-steel saddles, consisting of a base and a cylindrical body portion, the forward two of which are open at both ends, while the rear is open on one end only. The other end is cored and faced for a ball joint. The collector pipe, a 10¾-in. seamless steel tube, is passed through the cylindrical saddles and bottomed on a faced joint on the inside of the solid head of the rear saddle. These saddles are of such shape that an annular passage is formed between the collector pipe and the cylindrical shell, terminating at the bottom or base portion in a hole which registers with one of the 5½-in. holes in the boiler shell. The open ends are faced and bored to a sliding fit for the pipe and made steam tight by means of electric welding around the outside faces of the saddles and the collector pipe.

Around the periphery of the collector pipe at the portion covered by each of the saddles are drilled five rows of ⅝-in. holes, 20 in each row, making a total of 100 ⅝-in. holes, to conduct the steam from the 5½-in. boiler outlets to the interior of the collector pipe. The forward end of this pipe is swedged down to receive an 8-in. outside diameter seamless steel dry pipe which is securely welded at its rear end to the swedged portion of the collector. The dry pipe terminates at the smokebox end in a steel flange which is welded to the pipe and faced for a ball-joint connection to the shut-off valve. A cast-steel L-shaped shut-off valve body, provided with ball-joint flanges, passes through an open-



Canadian National 2-8-2 type locomotive built for freight service on the Western Region



Section of boiler showing

ing in the smokebox immediately in front of the circumferential seam, the vertical leg of which connects with a horizontal flange on the superheater header, while the horizontal leg is fitted to the dry-pipe flange. The shut-off valve, a flat disk of plate bored in the center to form a seat for the balancing valve and actuated by an Acme threaded screw, the initial movement of which unseats the balancing valve, has its seat on a forged-steel ring pressed into a suitable recess at the top of the vertical leg of the shut-off valve body. Faced lugs on the sides of the valve body are fastened by suitable anchor plates secured to the smokebox shell to relieve the body casting and dry pipe of any end thrust due to steam pressure.

Inside the boiler, immediately under the outlet openings, a shallow box of ¼-in. plate is tightly fitted to the shell and held in place by studs. The bottom face of this box or pan is perforated over the greater portion

Table of Dimensions, Weights and Proportions of the Canadian National Sample 2-8-2 Type Locomotives

Railroad	Canadian National
Builder	Canadian National (Pt. St. Charles Shops)
Road class	S-4-a
Type of locomotive	2-8-2
Service	Freight
Cylinders, diameter and stroke	24 in. by 30 in.
Valve gear, type	Baker
Valves, piston type	14 in.
Maximum travel	8¾ in.
Outside lap, main ports	2½ in.
Outside lap, compensated ports	2⅛ in.
Outside lap, auxiliary starting port	¼ in.
Exhaust lap	1/16 in.
Lead, constant	3/16 in.
Weights in working order:	
On drivers	237,000 lb.
On front truck	39,000 lb.
On trailing truck	61,200 lb.
Total engine	337,200 lb.
Tender	272,300 lb.
Total engine and tender	609,500 lb.
Wheel bases:	
Driving	16 ft. 9 in.
Total engine	37 ft. 8 in.
Total engine and tender	76 ft. 3¼ in.
Wheels, diameter outside tires:	
Driving	63 in.
Front truck	31¼ in.
Trailing truck	43 in.
Journals, diameter and length:	
Driving, main	12 in. by 13 in.
Driving, others	10 in. by 13 in.
Engine truck	7 in. by 12 in.
Trailing truck	9 in. by 14 in.
Boiler:	
Type	Inverted wagon top
Steam pressure	265 lb.
Fuel, kind	Bituminous
Diameter, first ring, inside	80⅞ in.
Diameter, third course, outside	90 in.
Firebox length and width	120⅛ in. by 84¼ in.
Arch tubes, number and diameter	2—3 in. O.D.
Syphons	2
Combustion chamber	23½ in.
Tubes, number and outside diameter	42—2¼ in.
Flues, number and outside diameter	167—3½ in.
Length over sheets	17 ft. 4 in.
Grate area	70.28 sq. ft.
Heating surfaces:	
Firebox and combustion chamber	339 sq. ft.
Tubes and flues	3,065 sq. ft.
Total evaporative	3,404 sq. ft.
Superheating surface	1,591 sq. ft.
Combined evap. and superheat	**4,995 sq. ft.**
Tender:	
Water capacity	11,000 Imp. gal. (13,200 U. S. gal.)
Fuel capacity	20 tons
Wheels, diameter outside tires	34¼ in.
Journals, diameter and length	6 in. by 11 in.
Rated maximum tractive force	56,200 lb.
Weight proportions:	
Tractive force ÷ comb. heat. surface	11.3
Weight on drivers ÷ tractive force	4.21
Total weight engine ÷ comb. heat. surface	67.7
Boiler proportions:	
Tractive force ÷ comb. heat. surface	11.3
Tractive force × dia. drivers ÷ comb. heat. surface	710
Firebox heat. surface, per cent of evap. heat. surface	9.95
Superheat. surface per cent of evap. heat. surface	46.8
Firebox heat. surface ÷ grate area	4.83

of its length with 468 ⅝-in. holes of an extruded form, through which the steam must pass before having access to the outlet holes.

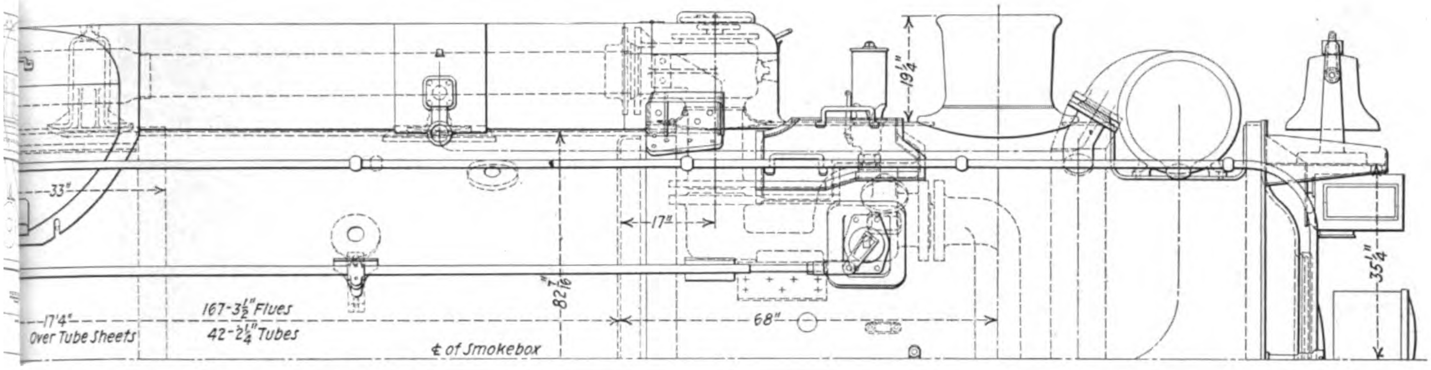
It was anticipated that, by spreading the steam-outlet area over a large extent of water surface in this way and baffling any sludge or entrained water by means of the extruded form of the perforations, some of the difficulties experienced could be overcome.

However, these expectations have not been entirely realized in service and the box or pan has since been altered.

In addition to the alteration made to the pan under the dry pipe and changing the feed pump, the front outlet hole in the boiler has been blanked off and the remaining two holes have been found of sufficient area to meet the steam requirements of the cylinders and auxiliaries in a satisfactory manner. While using the three openings, the locomotive showed a tendency to carry water and sediment into the dry pipe, especially during periods of surge such as follows a heavy brake application. Since the front opening was blanked, no further difficulty has been experienced and dry steam with a high degree of superheat is consistently maintained.

A 2½-in. iron pipe with flanged connections runs from the back end of the rear collector saddle to the cab turret on the right side. This pipe supplies saturated steam to a number of auxiliaries. The superheated-steam turret connects to a 2½-in. pipe which is carried along the top of the running board on the left side to a cast-steel auxiliary steam-pipe elbow passing through the smokebox near the top and connected directly to the superheater header.

A 13-in. by 15-in. manhole provides access to the interior of the boiler. This manhole is located on the top center line at the rear of the collector saddles and is closed by a cast-steel cover into which the safety valves are screwed. The dry pipe, collector pipe and saddles are lagged and jacketed and an external inverted U-shaped casing is fitted from the stop valve at the smokebox over the entire length of the boiler to the cab-turret casing. The sand box is made in two halves straddling the collector saddles, and the U-shaped



tside dry pipe and connections

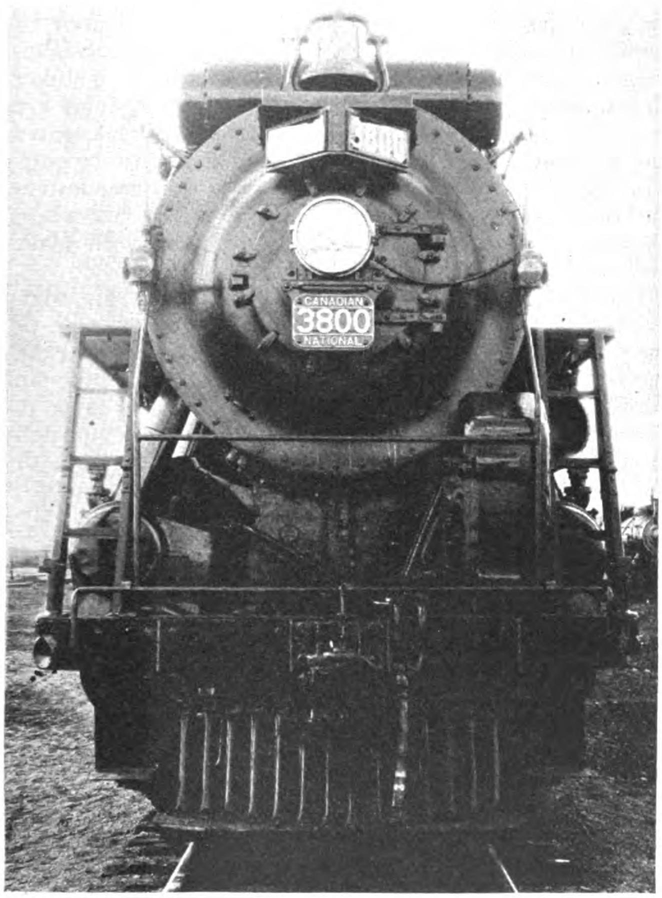
casing is fitted into it at the front and back faces, and into the cab turret casing, forming an unbroken outline from the front to the rear of the boiler.

Feedwater enters the boiler on the top center line of first course directly beneath the dry pipe. A small steel casting, with inlets at an angle of approximately 30 deg. on each side and tapped to receive 2-in. iron pipe, is riveted to the boiler. Short lengths of double-extra-heavy pipe, screwed and welded, join these inlets with cast-steel flanged elbows which extend beyond the U-shaped casing and serve to attach the right- and left-hand boiler-check valves.

Silicon steel is used throughout in the construction of the boiler shell, with the exception of the welt strap of the third course, from which the manhole is flanged and where ordinary open-hearth boiler steel is used.

Boiler Accessories

A Type E superheater with multiple throttle header is applied. The firebox, of liberal grate area, is fitted with two Nicholson Thermic syphons and two 3-in. outside diameter arch tubes and a 23½-in. combustion chamber. The somewhat limited tube length imposed restrictions at this point. The net firebox volume, after deducting the arch, syphons and arch tubes, is 361.25 cu. ft. Canadian National standard round-hole grate bars are used, which provide a free air opening of 11.8 per cent. An ashpan of moderate slope and ample capacity, fitted with Canadian National standard cast-steel hoppers and swinging doors, a type BK stoker, Franklin single-cylinder grate shaker and Franklin fire door, an Elesco feedwater heater and Superior automatic soot blowers complete the boiler and auxiliaries.



Front view of the Canadian National 2-8-2 type locomotive

Originally an Elesco centrifugal pump was fitted, but since going into service this pump has been replaced by a type CF-1 Elesco pump, which is supported on the same bracket cast on the left side of the cradle, below the ashpan, which was for the centrifugal pump. An H.N.L. injector is located on the right side.

The cut-off is limited to 64.8 per cent on the main ports, while on the auxiliary ports it is 83 per cent. An additional five per cent compensating cut-off is provided on the head end of each cylinder by a slight enlargement of three ports, still further improving the starting torque, and, with a factor of adhesion of 4.21, the locomotive showing little tendency to slip. The 14-in. piston valves are actuated by a Baker long-travel, long-lap type of valve gear.

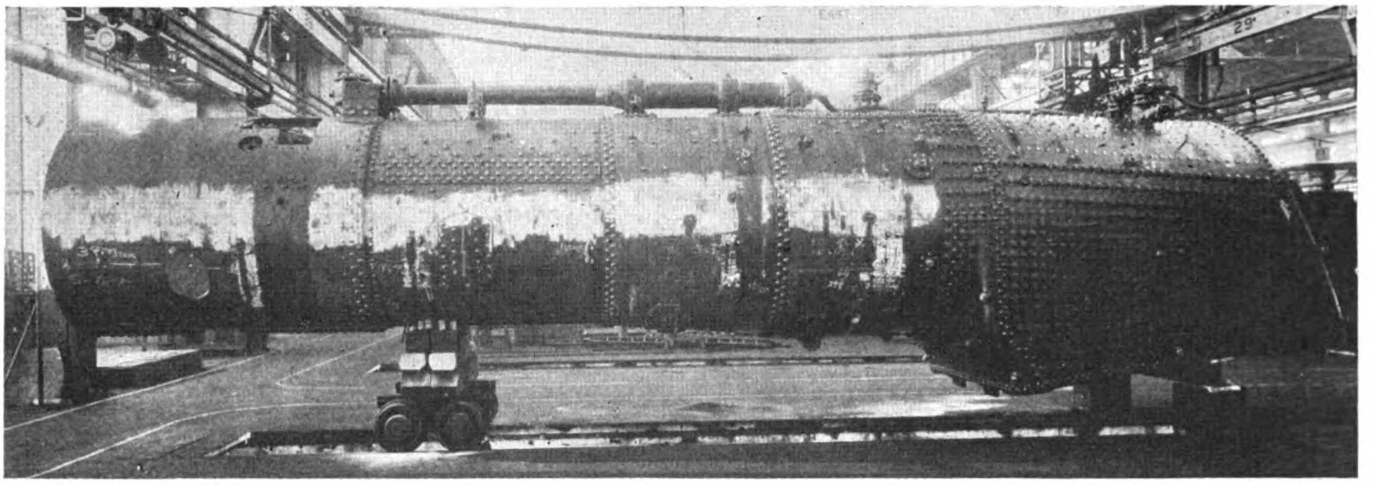
Frames and Running Gear

The main frames are nickel cast steel and the cylinders and steam pipes are nickel cast iron. The main and side rods are nickel steel. The main crank pins and axles are of Steel, Peech & Tozer quenched steel. The single guide bar is of nitrided alloy steel and forced lubrication is supplied to this detail, as well as to the valves and cylinders, by a Nathan D.V.S. lubricator on the right side.

The engine truck has outside bearings and provides 40 per cent constant resistance, while the trailing truck is the Delta outside bearing with 20 per cent constant resistance, both of General Steel Castings Corporation manufacture. The engine and trailing truck and the main driving journals are fitted with Canadian National standard revolving-bushing boxes.

Tenders of Unique Construction

The tender of this locomotive is of interest, being an improved design of the Canadian National standard frameless Vanderbilt tank, first introduced on a number of 4-8-4 locomotives built in 1929. The later design used on the No. 3800 was also applied behind 4-8-2 engines built during 1930.



Boiler of the Canadian National 2-8-2 type locomotive designed for service in bad-water territory

The Canadian National now has in service, or in the course of construction, more than 50 tenders of this same general arrangement. No underframe is employed. The bottom tank plate of 1-in. thickness forms the backbone to which the draw and center castings are riveted and welded. The internal bracing is of such a nature as to add substantially to the rigidity of the bottom structure. Tenders of this general design in service over a period of practically 2½ years have rendered satisfactory service. They have proved their ability to withstand the shock of collision and, although the body plates were ruptured, the under structure was found to be intact.

In the latter design, as used on the No. 3800, considerable lightening in weight, mainly in the castings, was effected and the compartment for housing the stoker engine was relocated. This compartment is now placed directly in the rear of the conveyor. The engine is carried on a cast-steel base plate and is connected to the conveyor gear shaft without using the customary shaft and universal joints. Only one joint is required for alinement purposes, making a more compact connection. Access is had to the compartment by means of a casing which passes out through the side of the tank and is fitted with a hinged door. The design of the vestibule diaphragm spring equipment has been modified and the diaphragm is now of all-welded plate construction. The rear bumper beam of cast steel has been eliminated and a structural steel platform of a design suitable for jacking has been substituted. The locomotive cab is also of welded construction, but of the railroad's standard design.

Rear view of the tender

Miscellaneous Equipment

A new style of coal gate has been fitted to the bunker of the No. 3800 and is giving satisfactory service. The customary construction using four or more leaves has been replaced by a single flat-hinged door. This door provides access to the coal space, and a small door of semi-cylindrical shape revolving on trunnions furnishes the necessary opening for hand-firing or adjusting stoker slides. Peep holes covered by small pivoted slides are provided so that a bar may be inserted to break down any arching of the coal before it is off the entrance gate. The front tank plate is not cut away to the same extent as before and can be substantially braced. Six-wheel General Steel Castings Corporation trucks with clasp brakes are applied.

One 8½-in. Westinghouse cross-compound air compressor is applied at the front end on the left side of the locomotive and is supported on a cast-steel bracket, carried from the frame and engine truck center-pin guide. A plate shield is fitted in front, as shown in one of the illustrations. The pump throttle is located on the auxiliary steam-pipe elbow at the left side of the smokebox. It uses superheated steam and is opened and closed by enginehouse forces. The whistle is attached at the same point and is operated by a cable through the left handrail.

The tender brake equipment is somewhat modified, an 18-in. brake cylinder with Type L triple and double chock valve being employed. The by-pass feature is inoperative and the triple functions in lieu of a brake-pipe vent valve. This arrangement is standard on most of the Canadian National heavy power.

Precision power reverse gear, Franklin safety bar and side-spring radial buffer of a special design to suit Canadian National clearance requirements are applied. An Elesco trap is fitted in the tender tank, the condensate and stoker exhaust being piped into it. Practically all iron piping on the engine and tender is welded, thus eliminating as many sources of leakage as possible.

EDITORIALS

Mechanical Department As a Traffic Builder

The motor bus and the private automobile have both cut heavily into the railroad passenger traffic and apparently much of this business has been lost permanently. On the other hand, there seems to be little doubt but what the railroads can regain some of this traffic, if they go about it in the right way; and, incidentally, there are possibilities that the mechanical department can render substantial aid in so doing.

Many people, after the novelty has worn off, find a growing dislike to driving long distances in their automobiles, and few people will confess to a liking for long distance traveling on a motor bus. They travel thus because it is cheaper or the schedules are more convenient. The smoother riding of the train makes it possible to read and do a certain amount of work with a reasonable degree of convenience, and many people prefer to use the train if their schedules meet their peculiar needs. Such people, however, complain of the dust and cinders, to the excessive noise on the train, and to the condition of the toilets on coaches. These, however, should not be insurmountable obstacles. Cannot the mechanical department find ways and means of overcoming them? The results would undoubtedly be clearly reflected in the larger number of people who would insist on traveling by rail, and this will be particularly true if ways and means can be found, at the same time, of speeding up the trains.

Study The Wheel Job

One of the most expensive items in connection with equipment repairs is the maintenance of wheels, by far the biggest volume of this work being devoted to the inspection, dismounting, scrapping or re-turning and re-applying of car wheels. The Wheel and Axle Manual, adopted as recommended practice by the Mechanical Division in 1928, presented for the first time in compact form reliable information regarding the proper handling of car wheels and axles. It has unquestionably been responsible for a marked improvement in wheel and axle practice, railroads generally benefitting in proportion to the thoroughness with which inspection forces and wheel-shop men have familiarized themselves with the contents of the book.

The Wheel and Axle Manual comprises the recommended practice of the Division with regard to specifications and design, manufacture, handling, storage and shipment of wheels and axles. There can be no question as to the desirability of the majority of these practices and, when not installed, the indication is plain that wheel-shop forces have not been adequately instructed. With respect to certain practices, such, for example, as the building-up of worn journal collars, some difference of opinion still exists. The manual recommends the reforging of axles as a better practice than building-up end collars by welding, because reworking of the material has a tendency to improve the grain structure. The welding of collars is now permissible under American Railway Association rules, but, pursuant to the action of the Mechanical Division at the 1931 meeting, a letter ballot will be sent out in the near future on the desirability of eliminating all welding in connection with car axles. While the proper annealing of axles subsequent to the welding operation relieves expansion and contraction stresses, the fact remains that if welding is permitted on one part of an axle, it may be extended to unauthorized places with resultant accidents such as have frequently occurred during the past few months.

Wheel mounting is another subject of great importance in which the Wheel and Axle Manual should be followed closely. A great improvement has been effected in this particular since the introduction of the manual, but some shops are still not provided with standard mounting gages. From the point of view of production cost as well as safety, wheel shop practices may well be examined into with the greatest care. One wheel shop machines a new axle complete from the rough-turned size in an average time for all classes of 60 min. per axle. If all shops on the system are not doing as well as this, steps should be taken to determine the reason, whether chargeable to man-failure, inadequate lathe equipment, poor cutting tools, or a lack of effective axle-handling equipment. One shop machines second-hand axles complete in 40 min. each; trues up lathe centers in axles, including necessary reaming, in 10 min. each; bores cast-iron wheels, including set-up and handling, in 8 min. per wheel; bores steel wheels to fit the axle, including setup and handling, in 20 min., and mounts cast-iron or steel wheels, complete, in 16 min. How does this time compare with the performance in your shop?

The Mechanical Department's Contribution

Some idea of the magnitude of steam-railroad operations in the United States can be gained from the fact that, in spite of handling less than the usual amount of business, Class I carriers burned over six million tons of coal and 165 million gallons of fuel oil in locomotives in June, 1931. This fuel cost almost 17 million dollars, as compared to about 21 million dollars spent by Class I carriers for locomotive fuel in June a year ago.

Of the many ways in which mechanical departments can contribute to operating efficiency and help the railroads meet the emergency created by present conditions, probably none is more important than the economical use of locomotive fuel. Next to labor (and, in recent years, taxes), fuel constitutes the largest single item of operating expense and one directly influenced by the work of the mechanical department. Not only does the mechanical conditions of cars and locomotives have an important bearing on the efficiency with which locomotive fuel is used, but refinements in design and improvements in locomotive details may well be carried to completion during the present period in order that railroads may capitalize to the greatest possible extent on reduced unit locomotive fuel consumption.

Commendable efforts along this line have been made by a number of roads, such, for example, as the Illinois Central, in developing the Mays front-end arrangement, which is named in honor of the present general superintendent of motive power, and has already accomplished marked results in fuel economy. Experiments with locomotive front-end designs have been going on for many years with a varying degree of success and it might be supposed that further improvements could hardly be anticipated. Apparently, such is not the case since the new front-end arrangement, embodying a combination of the "Goodfellow" exhaust tip and the basket bridge, is credited with an actual average fuel saving of 12.5 per cent in fuel consumption, as compared with the old-style front-end arrangement. The details of this test, which will be published in a subsequent issue of the *Railway Mechanical Engineer*, indicate that the use of the Mays front-end permitted increasing the nozzle diameter of a Mountain-type locomotive, for example, from 6⅜ in. to 7⅜ in., resulting in a reduction of back pressure to a maximum of 3½ lb., with attendant increases in available tractive force reduced water consumption and lessened maintenance on account of smaller back-pressure stresses.

Almost a thousand locomotives on the Illinois Central have already been equipped with the Mays front-end arrangement, which not only promotes fuel economy on individual locomotives, but also permits Pacific-type locomotives of 40,758 lb. tractive force, for example, to be used in place of Mountain-type locomotive of 51,121 lb. tractive force, hauling heavy passenger trains on fast schedules. The overall economies are such that the fuel consumption per 100 passenger-car miles is reduced as much as 25 per cent. With an average cost per locomotive for the installation of the new type of front-end of $25 each, the outstanding improvement in locomotive performance and reduction in operating expenses is paying a handsome return on the cost of developing the equipment.

Interchange Rules and Car Inspectors

On The Reader's Page of this issue is a letter by T. J. Lewis which is one of a series of exchanges following the publication of the abstract of H. R. Rice's address before the Indianapolis Interchange Car Inspectors Association which appeared in the Feburary issue of the *Railway Mechanical Engineer*. Mr. Lewis, himself an inspector, has ably presented the inspectors' viewpoint with respect to Mr. Rice's contention that much of the discussion of the application of the rules of interchange at meetings attended by inspectors pertains to "trick questions".

The opposing viewpoints held by these two men are probably typical of those held by large opposing groups of men, even in the car department, and certainly by large opposing groups in the transportation and operating departments and the car department.

While nothing that may be said in these columns is likely to compose these opposing viewpoints as to what are useless technicalities and what are points for constructive consideration, it may be worth while to point out why technicalities or even "trick questions" would probably continue to arise as long as a code of interchange rules is involved in railroad operation. The reason lies not in the mental peculiarities of the men whose responsibility it is to apply these rules at the hundreds of interchange points throughout the country, not does it lie in the character of the rules as they have been developed up to the present time. It is inherent in the very nature of any set of rules developed to control the actions of men in situations where opposing interests are involved.

The intent of the rules of interchange is set forth in three sentences in the preface. If all men agreed as to what is a "fair and proper adjustment" in specific instances as readily as they agree to the fairness and soundness of these three basic purposes of the rules the preface might well constitute the entire code. But, because men with the same standards of fair dealing cannot agree as to what is fair and proper in the innumerable varieties of specific cases more than two hundred pages of rules are required to interpret the meaning of three simple sentences, and nearly 1,700 decisions in arbitration cases have been required to interpret the meaning of the rules.

A rule is of little value unless it is specific. Unfortunately, the more specific the rule, the less ground it can cover. Hence the difficulty in making its application clearly apparent to the many combinations of circumstances which, as our correspondent says, are as numerous as the potential combinations of a Yale lock.

It is unfortunate, but none the less generally true, that in making rules so specific that they may be applied with a reasonable degree of uniformity by different men —which is the test of their practical value—they must in some measure compromise the principles which they are designed to carry into effect. Rule 32 is probably as good an illustration of this point as any. It does not necessarily imply a lack of sincerity on the part of those responsible for bringing up the many cases involving this rule, which are settled against them because, technically, none of the conditions specifically set forth in the rule applies. Many of these lost cases are within the spirit of the rules, but to make exceptions in deciding such cases would soon destroy the rule. Once established, the letter of the rule of necessity becomes more important than the principle.

Rules being what they are, interchange inspectors, if they do their jobs correctly, must of necessity be technical. If the rules are to continue effective, these men cannot substitute their own judgment in any situation for the intent of the rule, as the words in which it is framed, convey that intent to them. There is but one alternative for technicalities and "trick questions" in dealing with the interchange of cars between railroads; that is, no rules at all.

Whether it is better to place the entire burden of the cost of maintenance in interchange, say, on the car owner, or to continue the present code of rules with its burden of technicalities and delays, not to mention dollar swapping accounting, is purely a matter of expediency. There are responsible car men who believe that something like the former course is the most desirable and there are many who are in favor of a middle ground course in which the number of billable defects would be materially reduced. Either course would undoubtedly increase the amount of unfairness in specific cases, but those favoring either of these proposals believe that in the aggregate no essential unfairness or essential change in net debit and credit balances in expenditures for interchange maintenance would result.

The practicability of some such modifications of the rules will probably be the subject of study by the Arbitration Committee during the coming year. In the meantime the railroads will have to accept technicalities

and give serious attention to the discussion of trick questions, so-called, as the price of maintaining a set of interchange rules. The tricks are in the rules, not in the questions.

Fabricating Aluminum Car Parts

The demand for greater economy in railway operation has led to an increasing urge in recent years for lighter equipment or, in other words, cars which will handle the same number of passengers or the same number or tons of freight without the expense involved in moving excessive amounts of tare weight. The result of this demand has been the study of light-weight designs and the use of lighter materials, one of the most important of the latter being the strong alloys of aluminum.

An examination of the records shows that aluminum was first applied extensively in steam-railroad service in composite, steel-aluminum, multiple-unit suburban cars on the Illinois Central in 1923. In 1926, the Pennsylvania went a step further by constructing multiple-unit cars with all parts above the underframes made of aluminum. For the past year and a half, the larger commercial shapes and plates of aluminum have been available in sufficient lengths for the longest cars, and multiple-unit electric railway cars are now in service in which practically the entire car bodies, including the underframes and superstructures, are made of aluminum.

In general, strong-aluminum alloys of the duralumin type are used for the stress members and girder sheets, unheat-treated aluminum alloys being specified for the interior finish, conduit, fittings, etc. Experience with these cars apparently indicates that aluminum construction is well adapted to stand the hard usage encountered in both electric and steam railway service and it seems certain that within the next few years railway car-department supervisors and repair forces generally will be required to deal with a considerable amount of equipment built largely of aluminum.

A study of the construction of all-aluminum cars shows no great departure from the general practices involved in building and repairing steel cars. The two most striking characteristics of aluminum include light weight—which is very apparent and an important advantage in shop handling—and high heat conductivity, which rapidly dissipates heat applied in welding or through the application of hot steel rivets. Welding operations, when necessary, can be carried on by experienced operators on aluminum without unusual precautions, but the strong-aluminum alloys cannot, of course, be welded without losing their physical properties acquired by heat treatment.

Strong-aluminum plates and shapes can be worked to a certain extent cold. They can also be worked to a limited extent hot, providing the temperature is not permitted to exceed 300 to 400 deg. F., which must be accurately determined by a pyrometer or other means, as aluminum has a relatively narrow critical range and heating much above the temperature mentioned will result in a loss of physical properties due to heat treatment.

It is interesting to note, in connection with one lot of all-aluminum multiple-unit cars now in service, that the center sill is made of a strong-aluminum plate pressed cold, the side sills of rolled strong-aluminum angles, the body bolsters and cross bearers built up of diaphragms pressed cold, side and end posts of box-section aluminum pressings, carlines of pressed aluminum, and girder sheets, letterboard, inside finish, headlining and other details of aluminum sheets. In constructing the pilots made of aluminum angles and tubing, several sharp bends were required which could not be made cold successfully and required local heating, not to exceed 400 deg. F., to avoid fracture of the material. With suitable precautions against overheating, however, this bending, which involved practically a forging operation, was successfully carried out on the strong-aluminum angles and tubing used in the pilots. All pressings were made in a hydraulic press of the proper capacity, using dies similar to those employed in manufacturing steel car parts, and about the only precaution observed was to follow the recommended general practice of making the radius of curves at least four times the thickness of the material.

In view of the noticeable trend toward lighter railroad equipment and the probable greatly increased se of aluminum alloys in car construction within the next few years, railway car-department officers and supervisors will not overlook the opportunity to acquaint themselves in advance with the characteristics and advantages of this relatively new material as well as the best methods of working it.

NEW BOOKS

METAL STATISTICS, *1931. Published by the American Metal Market, 111 John street, New York. 4 in. by 6 in., 552 pages. Price $2.*

This, the twenty-fourth annual edition of Metal Statistics, contains the same general assortment of statistical information concerning ferrous and non-ferrous metals that has been supplied in previous years, but various new tables have been introduced and the economic data increased. Data on population, income, wealth, car loadings, etc., have been included, also data on the production of steel ingots and castings as far back as these statistics are available, and steel industry operating rates and fabricated structural steel shipments. In non-ferrous metals further additions have also been made covering production, stocks, prices, etc.

TREATISE ON LEATHER BELTING. *By George B. Haven, S. B., professor of advanced machine design in charge of textile research, and George W. Sweet, S. B., professor of machine design, both of the Massachusetts Institute of Technology. Bound in cloth, 5½ in. by 8 in., 249 pages. Published by the American Leather Belting Association, New York. Price $1.50.*

The book takes the reader from the first stage in leather manufacture through all stages of the work required to transform the raw hide into finished belting leather and describes the different kinds of leather and their proper field of use. It also presents in detail the various grades and weights of belting available; the right pulley to use and why; practical rules governing the application of belts to machines; tables of horsepower developed at different belt speeds; proper use of idlers; short center drives; hinged motors for short center drives, and other features of belt drives.

A chapter is devoted to the care of leather belting and another on motor drives; relative value of group and individual drives; table of costs, etc.

THE READER'S PAGE

Why Two Oils— Summer and Winter?

To THE EDITOR:

It is my opinion that there is no good reason for the use of two oils. During the warm weather very little trouble is experienced with hot boxes due to lubricating conditions, but it is when cold weather sets in that hot boxes appear due to improper lubrication. This is on account of congealed oil which prevents the free flow of oil to the bearing especially on cars that have stood around yards, where the journals are cold, and are then placed in trains. Congealed oil is also responsible for the rolling of packing. Some oils do this more than others. When the packing is rolled away from the journal at the time a train is started from the terminal, hot boxes are bound to develop.

One way to overcome hot boxes to a considerable extent would be to gage the oils by the cold weather performance, as that is when we are having trouble. At present, too much heavy or summer oil is used on account of the larger number of cars being repacked in warm weather, thus creating hot-box trouble for cold weather.

After a car has been repacked and heavy summer oil is used, the first thing that happens when entering cold weather is the rolling of the packing away from the journal. The only remedy is the use of a cut-back oil or a light grade of oil to break up the congealed oil, permitting it to flow to the bearing and allowing the packing to stay in its proper place. In applying this remedy, it often becomes the practice to overdo the application of the light oil. This results in too light an oil for summer use as the oil will lay at the bottom of the box and cease to lubricate.

In arriving at a one-season oil, an oil should be used that will not become too heavy or sticky in cold weather and that will flow from an oiler without the application of heat. This will eliminate the use of light oil as a thinner.

Another feature that is sadly neglected and which has a great deal to do with the congealing of oil in journal boxes is the proper maintenance of the dust guard and application of covers that will exclude the greatest amount of dust. The journal-box face should be finished so as to permit the cover to fit closely.

To prevent the rolling of packing in journal boxes is the one big thing to prevent hot boxes.

T. P. SCHMIDT.

The Big Car Shop

To THE EDITOR:

Mr. Richmond's article on whether or not the big car shop is justified brings out many interesting points on the car maintenance problem and matters that require deep study. Personally I am in favor of the concentration of car work and believe the past practice of attempting to do a lot of big things in a lot of little places seriously affects the cost of car maintenance. Many roads formerly repaired cars (and some still do) as they failed or became wholly unfit for any service, instead of anticipating and arranging for repairs to cars by series after specified number of years of service, preventing in this way consequential damage due to weakened parts, deterioration from corrosion and providing the traffic department with better cars.

In addition to this saving, the costs of repairs are materially reduced by the systematic repairing of cars by series, and the reduction of store stock carried over a long period to protect cars that become unfit for service intermittently results in a real saving and reduces obsolescence of material.

I believe the term "major shop" is more appropriate for most railroads and were I asked for my views on this matter, I would recommend major shops geographically located to care for cars as they come to the point where the loading originates which prompted the management to purchase equipment of the type in question.

On the Illinois Central, as an example, we now have three car shops that could be termed major shops. One located at McComb, Miss., where all refrigerator cars are given classified repairs. This shop is close to the originating point of our bananas and in the valley that grows fruit and vegetables in large quantities. At Nonconnah, near Memphis, Tenn., we have a major shop where all house and flat cars are repaired. This shop is in the center of northern and southern lines and cars leaving this shop receive such loads as coffee, sugar, grain, cotton-seed products, lumber, logs, piling, etc. At Centralia Ill., we maintain a major shop for the repairing of coal cars. This shop is located in the center of the Southern Illinois coal fields and in line with the movement of empty coal cars from the north to the Kentucky coal field.

The above reference to the cars repaired at these shops takes into account classified repairs, as emergency repairs are made to all types of cars at these shops. Formerly this classified work was spread over 14 to 16 points.

Mr. Richmond's criticism of the big shop is not justified in its entirety as it has many good points. Among the most important are the housing of cars and men, eliminating the application of rust preventatives and paint to surfaces at low temperatures or wet from rain or humidity, permitting men to dress so they can work efficiently, and the handling of heavy parts by cranes and modern appliances.

Light repairs can be made in a big shop at times when no classified repairs are available or the condition of the traffic does not warrant such repairs, and at a saving. The big shop cannot be condemned for this reason as one railroad has gone into this feature and proved to its own satisfaction that in a modern shop light repairs can be handled more efficiently and at a real saving to the railroad.

Mr. Richmond's article touches on the classification of repairs showing how the Interstate Commerce Commerce Commission classified repairs and an example of how some roads have set up a yard stick of man-hours for classification purposes. The Illinois Central is the only railroad I know of which has set up a definite workable system of knowing exactly what their classified repairs are costing and are classifying their repaired cars accordingly

The words "estimated cost" have been eliminated from our vocabulary as far as the cost of classified car

repairs are concerned on this road. Man-hours may be of some help but in no way reflect the cost and as far as estimates are concerned they are guesses by car foremen and others and, as no one has any real data to check them, their guess or estimate is accepted as the best solution of the problem.

On the Illinois Central, after several cars of a certain series are repaired we know exactly what the labor and material costs are and have no trouble in arriving at the cost to repair cars in the same series. This plan has been of great assistance to our general officers in arproperly arriving at the cost of repairs to cars set aside.

W. J. McCloskey.

One Car Oil For All-Year Performance

To the Editor:

In the letter entitled "Limited Use of Free Oil Defended," which appeared on The Reader's Page of the June, 1931, issue, "Car Department Officer" raises the question "Since boxes are repacked only once a year, why two oils—summer and winter?" Having spent six years in intensive work connected with this same question, perhaps I can inject some interesting high lights into the discussion.

Traditional practice has carried on since the beginning, but is due for a change. A summer journal oil having a body weight from 65 to 75 sec. at 210 deg. F., with an average cold test of 15 deg. F., is the primary cause of waste grabs and congealed packing at temperatures below 30 deg. F. We know that 70 per cent of box failures occur during zero and sub-zero temperatures. As a concrete example, flushing oil for crank cases of automobiles has a weight of 38 sec. at 210 deg. F., but at zero this body weight increased to 10,000 sec This will give you a slight idea of what occurs at cold temperatures.

Major railroad officers are coming to the point of accepting an all-year car oil. The most suitable product produced so far is a winter oil with a body weight of 50 sec. at 210 deg. F., or one with a film strength sufficient to keep the metallic surfaces separated on new installations, such as new wheels, new or broached brasses, etc. We have found that an oil of this type will carry the new installation and, with a cold test of between minus 30 and minus 40, this oil does not congeal and cause waste grabs, with resultant box failures when used for the entire year.

We have found when we run into the extreme minus temperatures ranging from zero to 50 deg. F. below that then it is necessary to use a cut-back or thinning oil which has a cold test ranging from minus 50 to minus 75. This product, when applied to the front of the journal and around the collar, washes the heavier oil back toward the fillet and it then settles in the cellar of the box, leaving the light oil on top of the waste and, in turn, it is wiped onto the journal. This is a much better practice than using engine wiping oil, kerosene and distillate, as has been the practice on some of the roads operating in the colder ranges for some time past.

If you will look over the car-mileage records for hotbox failures, you will note that the mileages are increasing between failures each year. The writer knows personally where this practice has more than doubled and trebled the performance on several major lines, and it is an ordinary circumstance today to see such records as 200,000 to 500,000 box-car miles per hot box.

We believe the time is fast approaching when one oil only will be used for all-year performance and, when necessary, a cold-weather car oil, or cut-back oil, will be used as a supplement during the sub-zero ranges of temperature.

An Oil Man.

But Are They Trick Questions?

To the Editor:

In his letter on page 372 of the July issue of the *Railway Mechanical Engineer*, H. H. Rice takes exception to my reference to the study of Latin by way of illustrating a point. The study of Latin referred to by him as having been dropped as a mandatory study from the high school curriculum Tee's off with the vacant rules in the A.R.A. code, also mentioned by him, instead of with the discussions in the car foremen's meetings. Live discussions do not come out of dead issues, Old Man Sampson's yarn about the honey bees in the lion's skull, notwithstanding.

Mr. Rice's arithmetic is correct, but his assumption that twenty questions can be discussed and disposed of at any one meeting of reasonable duration is far from the real facts. He says further, "And as the majority of questions cover only a few of the rules it can readily be seen that the field for legitimate questions is rapidly covered." No rule is ever covered by any question, or any number of questions. Just when you think you know the last thing about the application of a rule to interchange work, up will bob a case just like a hundred you've handled before—only different; and you can't find a parallel to it in all the 1664 cases that have already been handled by the Arbitration Committee. Many of the rules are as full of potential combinations as a Yale lock when it comes to applying them in actual practice.

Where there are as many as twenty inspectors, each on a live interchange job, there will be no lack of "legitimate" questions for discussion, if they are not too backward about relating their experiences. Most car inspectors are not given to doing much talking in a meeting and require much drawing out to get them to say anything at all. If, as is often the case, there is not a skillful leader to direct the discussions, the meeting is apt to fall flat or drift into channels not suited to the occasion. This is unfortunate for the men and more so for the railroads for which they work, because their interest in their work is slackened by the failure of the meeting to produce the results desired. Men do not attend these meetings for fun, nor for the purpose of learning new tricks by which to delay traffic. Their attendance is evidence of an earnest and very commendable effort to learn to do their work better. What they need is real help and direction, instead of a lot of adverse criticism.

Mr. Rice's letter implies a lack of confidence in the sincerity of the car department officers who submit their disagreements to the Arbitration Committee for decision—that they are fellows of loose morals who know they are wrong to begin with, but since they have no confidence in the integrity of the members of the committee, they think perhaps they will be able to "put one over" and filch something from another company for their own. If that be true, verily they should all quit their useless jobs and assist the traffic department.

T. J. Lewis.

With the
Car Foremen and Inspectors

Checking Braking Force on Cars

FREQUENTLY rip-track foremen and car inspectors are required to check the braking force of cars not equipped with badge plates or for which blue prints showing the correct lever dimensions are not provided. The following instructions have been issued by the air-brake supervisor of an eastern road to facilitate the checking of such cars:

Brake-cylinder values for various pressures are shown in the table. Assuming a brake-cylinder value of 3,925 lb. and a braking force of 7,200 lb. per beam or 3,600 lb. per shoe with truck levers 6 in. and 18 in. as shown in the diagram; then 7,200 multiplied by 4, or 3,600 multiplied by 8, equals 28,800 lb. total brake-shoe pressure. Divide 28,800 by 48,000 and the result is 60 per cent.

Taking the problem another way. If it is known that the light weight of a car is 48,000 lb., then 60 per cent of 48,000 is 28,800 lb.

One of the primary features to bear in mind when computing the result of applying a force at one end of a lever and getting something else at the other end is that the force applied multiplied by the distance from the point the force is applied to the fulcrum, divided by the distance from the fulcrum to the point the force is delivered, gives the force delivered. Taking the total cylinder value of

$$\frac{10.375 \times 3{,}925 \text{ lb.}}{22.625} = 1{,}800 \text{ lb.}$$

The second step will be to multiply the force on the pull rod by the distance from the point the force is applied to the fulcrum of the truck lever which, in this case, is 24 in. This is divided by 6:

$$\frac{1{,}800 \times 24}{6} = 7{,}200 \text{ lb.}$$

If it is desired to know the force exerted on the truck-lever connecting rod; the force on the pull rod multiplied by 18 divided by 6 equals 5,400. This figure, 5,400 lb. multiplied by the distance from the point the force is applied to the fulcrum (24 in.) divided by the distance from the fulcrum to the point the force is delivered (18 in.);

$$\frac{5{,}400 \times 24}{18} = 7{,}200.$$

To know what brake-shoe pressure is delivered on the end equipped with floating lever, it is necessary to determine the force exerted on the brake cylinder connecting rod. If the brake-cylinder value is 3,925 lb. and the force on pull rod is 1,800 lb., the sum of these two forces will be the pull or force exerted on the brake-cylinder connecting rod, 5,725 lb. Multiply the cylinder value of 3,925 by the total length of the cylinder lever (distance from the point the force is applied to the fulcrum) and divide by the distance from the fulcrum to the point the force is delivered:

$$\frac{3{,}925 \times 33}{22.625} = 5{,}725$$

Also 1,800 lb. multiplied by 33 (distance from the point the force is applied to the fulcrum) divided by the distance from the fulcrum to the point the force is delivered, is

$$\frac{1{,}800 \text{ lb.} \times 33}{10\frac{3}{8}} = 5{,}725$$

Knowing that the force of the brake-cylinder connecting rod is 5,725 lb., the force delivered to the pull rod will be 5,725 times the distance from the point the force is delivered (27 in.)

$$\frac{5{,}725 \times 8\frac{1}{2}}{27} = 1{,}800 \text{ lb.}$$

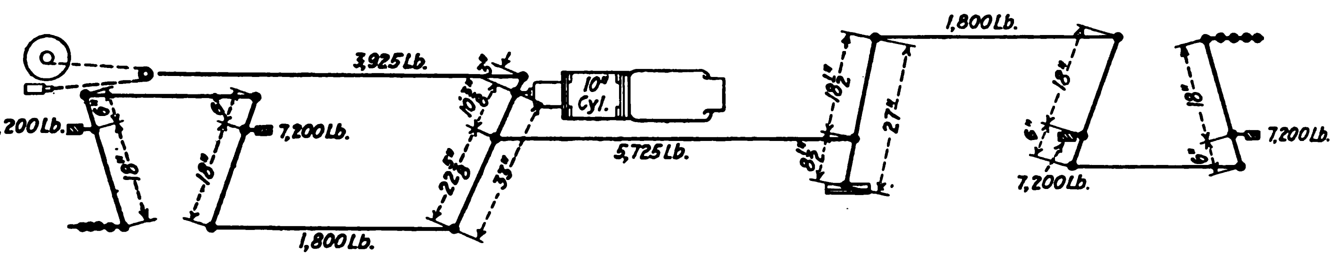
The method of determining the force delivered at the brake shoe is the same, as explained, for the other truck. This is a practical means of determining the total brake-shoe pressure and the relation of the total brake-shoe pressure to the light weight of the car. This is known as braking ratio.

Brake-Cylinder Values for Different Pressures

Diameter, in.	Area, sq. in.	Force: 50 lb. per sq. in.	60 lb. per sq. in.	85 lb. per sq. in.	100 lb. per sq. in.
6	28.3	1,400	1,700	2,400	2,830
8	50.1	2,500	3,000	4,250	5,010
10	78.5	3,950	4,700	6,700	7,850
12	113.1	5,650	6,800	9,600	11,300
14	154.0	7,700	9,250	13,100	15,400
16	201.0	10,050	12,050	17,100	20,100
18	254.0	12,700	15,250	21,600	25,400
2—8	100.5	5,050	6,050	8,500	10,050
2—10	157.1	7,850	9,400	13,400	15,710
2—12	226.0	11,300	13,600	19,200	22,600
2—14	308.0	15,400	18,500	26,200	30,800
2—16	402.0	20,100	24,100	34,200	40,200
2—18	508.0	25,400	30,500	43,200	50,300

In checking the braking force it may be found to be more or less than it should be, in which case it will be necessary to properly locate the fulcrum points in both the cylinder and floating levers

The following is the proper procedure:



Sketch of brake-rigging diagram for use in checking the braking force on cars not equipped with badge plates

1—Locating the fulcrum points on the cylinder lever when an 1,800-lb. pull is necessary on the pull rod. The brake-cylinder value (3,925 lb.) times the total length of the cylinder lever (33) divided by the sum of the brake cylinder value (3,925 lb. and 1,800 lb.) is

$$\frac{3{,}925 \times 33}{3{,}925 + 1{,}800} = 22.625$$

This is the B end—33 minus 22.625 equals 10.375 in.—this is the A end of the cylinder lever.

The next step necessary is to properly locate the fulcrum point on the floating lever. Knowing that the force on the pull rod is 1,800 lb., the total length of the floating lever is 27 in. and the force on the cylinder lever connecting rod is 5,725 lb., multiply 1,800 lb. by the total length of the floating lever and divide by 5,725 lb., is

$$\frac{1{,}800 \times 27}{5{,}725} = 8.5$$

This is the length of the short end of the lever which must be connected to the fulcrum point. Twenty-seven minus 8.5 equals 18.5, the distance from the fulcrum to the pull-rod connection or the point at which the force is delivered.

Before it will be possible to properly locate the fulcrum point on the floating lever it will be necessary to determine what force will be required on the pull rod to develop 7,200 lb. per beam or 3,600 per brake shoe. If the truck lever is 18 in. and 6 in. the sum of 18 and 6 is 24

$$\frac{24}{6} = 4; \text{ and } \frac{7{,}200}{4} = 1{,}800$$

Stenciling Freight Cars

THE illustration shows the type of stencil used in applying road initials, car number, capacity, load limit, weight figures, etc., to freight cars overhauled and repainted at the Milwaukee (Wis.) shops of the Chicago, Milwaukee, St. Paul & Pacific. A one-piece stencil. made of Monel metal with 14-gage round wire binders and mounted in a light frame, is used. On cars of the type illustrated, two of these large stencils are all that are required for application of most of the lettering.

In use, the stencil frame is pegged to the side of the car in the correct location and small one-pint cup spray guns, with gravity feed, used to apply the paint. Owing to the use of the wire binders which do not bear against the side of the car, a slight tilting of the spray gun, each way, permits paint to be applied directly under the wire binders, and full, uniform letters and figures result. When not in use, all stencils are carefully stored in a rack at the side of the shop where they are always available. The use of thin Monel metal sheets has proved economical, owing to the greatly-increased durability of the stencils and the fact that they can be cleaned readily, facilitating neat workmanship and reducing the expense.

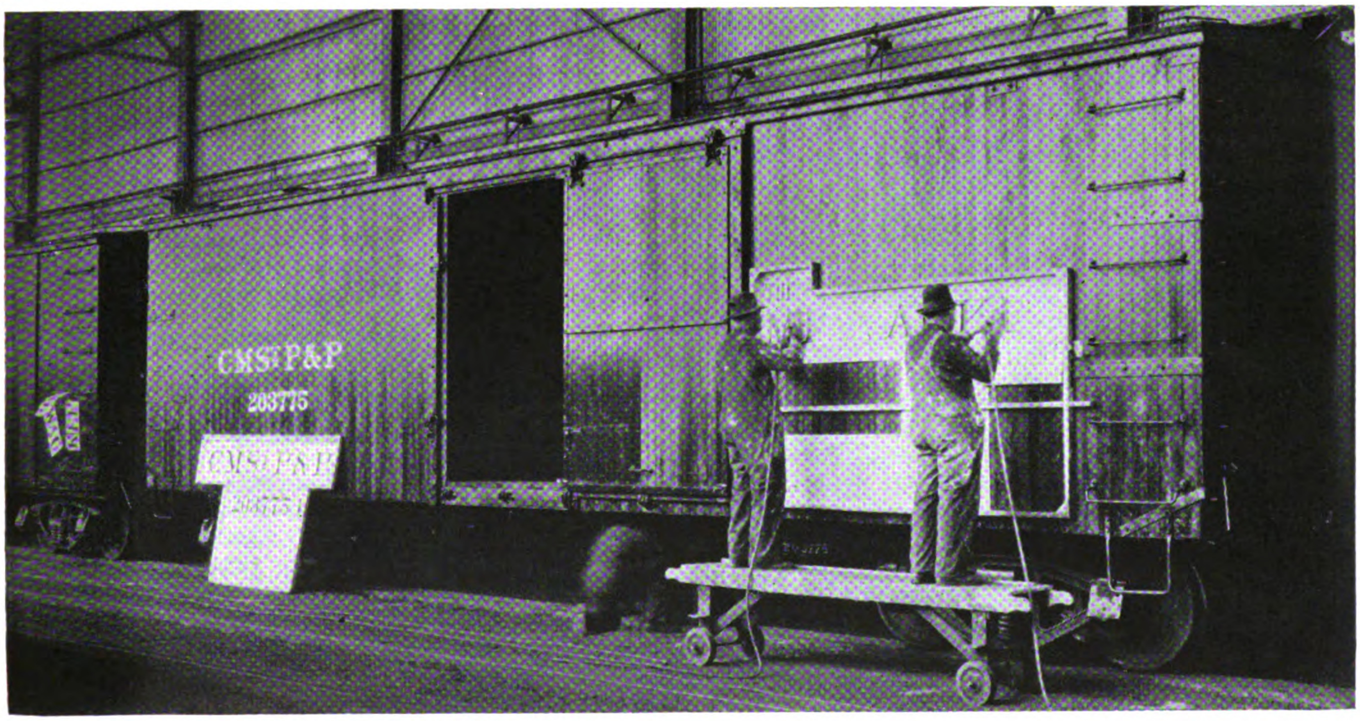
The illustration also shows a convenient four-wheeled platform used by the painters in applying stencil letters, the construction being plainly shown. The light weight of this platform, together with the wheel design, makes it readily portable and convenient in use. At the same time, the well-braced steel leg construction provides a rigid platform upon which the painters can work with every assurance of safety and with maximum convenience.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Express Charges on Coupler and Yoke Paid by Handling Line

American Railway Express car No. 793 was found at Chicago on the line of the Chicago, Milwaukee, St. Paul & Pacific on February 2, 1929, with a coupler, cast-steel yoke, and vertical key missing from the B end of the car. The C. M. St. P. & P. was unable to locate the missing equipment and ordered a coupler and yoke from the car owner. These were shipped by express, the charges for which amounted to $3.65. The American Railway Express Company contended that under Rule 95 the missing material was to be considered as undamaged and, therefore, it refused to pay the express charges. The railroad contended that the defective condition of the car was owner's responsibility and, as it had charged for the labor of making the repairs, it was therefore correct also to include the ex-



Monel metal stencils and convenient painter's platform used at the new freight-car shops of the C., M., St. P. & P. at Milwaukee, Wis.

press charges in the bill against the car owner. The express company pointed out in its statement that it shipped two couplers from its storeroom at Chicago, but not having a yoke standard to the car, an order was placed with the Union Pacific for a yoke to be shipped from Omaha, Neb., as the car was built to Union Pacific specifications. The railroad furnished two defect cards at the request of the express company. One card was used as authority for billing the railroad for the two couplers and the other card was sent to the Union Pacific as its authority for rendering a bill for the yoke furnished. The C. M. St. P. & P. billed for both labor and material, later issuing counterbilling authority for the value of the coupler and yoke which were applied to the B end of the car. It subsequently billed the Railway Express Agency for the express charges. Payment was declined as the express company contended that only labor could be charged for replacing couplers and yokes lost on the repairing line inasmuch as Rule 95 makes the delivery line responsible. The car owner contended that the repairing line should be responsible for any expense involved in procuring this material and that it believed the express charges should be considered as part of the cost of the material.

In its decision the Arbitration Committee stated: "The contention of the Railway Express Agency is sustained."—*Case No. 1670, Chicago, Milwaukee, St. Paul & Pacific vs. Railway Express Agency.*

Car Damaged by Coupling Up When Switching—Subject to Rule 44

Menasha Woodenware Corporation received an inspection report of defects on its wood-underframe box car No. 50, dated May 17, 1930, under Rule 120. The repairs amounted to a labor charge of $286.10 and a material charge of $472.92, a total of $759.02. The car owner refused to consider the damage, which consisted primarily of a broken end and side sills, sheathing and roofing, as owner's responsibility. According to the statement of the Chicago, Milwaukee, St. Paul & Pacific, the car was standing with three other cars behind it, all coupled. A locomotive with about 20 cars backed in and coupled to the four cars, of which M. W. W. car No. 50 was the first. The locomotive with the 24 cars then backed further along the same track and coupled to three other cars. The locomotive and the 27 cars were backed still further along the track and coupled to eight or nine additional cars. After this last coupling was made the bad-order condition of M. W. W. car No. 50 was noticed when a coupler on the car dropped down. All the cars which had been standing on the track in question were loaded, with the exception of M. W. W. car No. 50. The car owner contended that the car evidently failed when the first coupling was made, because it was the first car struck and that it was handling-line responsibility according to Rule 32 conditions. The railroad stated that its investigation failed to support such contention and that there was no derailment or other condition which involved Rule 32. It pointed out in its statement that the handling line obviously did not inspect the car after each coupling and is assuming that the damage did not occur until the last coupling was made, when the defects were first noticed. The Menasha Woodenware Corporation is not a subscriber to the A. R. A. Rules, but agreed to abide by the decision of the Arbitration Committee.

The Arbitration Committee decided that: "The damage to this car, occurring under the circumstances stated by the Chicago, Milwaukee, St. Paul & Pacific, does not constitute unfair usage under any of the provisions of Rule 32. The contention expressed in the statement of the car owner as to the circumstances under which damage occurred, being unsupported by any evidence, is inconclusive. Car owner is responsible."—*Case No. 1671, Chicago, Milwaukee, St. Paul & Pacific vs. Menasha Woodenware Corporation.*

Rules in Effect on Date Repairs Are Completed Govern Prices

Chicago, Rock Island & Pacific car No. 185473 was repaired by the Chicago & Alton on January 4, 1930, at Slater, Mo., and a billing repair card was attached to the latter's bill to the car owner. This stated that the car was derailed on the Chicago & Alton at Mt. Leonard, Mo., on December 23, 1929, and that the responsibility for the expense of the repairs was divided between the car owner and the handling line. Charges were made for the renewal of one cast-steel Andrews truck side, four journal-box bolts, eight tie-bar rivets, eight spring-plank rivets, and eight truck-channel rivets. The handling line claimed that the failure of the truck side was the cause of the derailment. The car owner contended that the A. R. A. rules in effect on the date the repairs were completed governed and that the C. & A. was responsible for the expense of all the repairs listed. The Rock Island in its statement referred to page 2 of the Arbitration Committee Circular No. 3—1915-1916, in which it was stated: "Each successive Arbitration Committee has held that no hypothetical cases will be considered and that all cases will be arbitrated under the rules in force at the date of the card." It contended that its position was supported by Arbitration Decisions 615 and 716, and stated that it did not believe that the prices in A. R. A. Rules for one period are to be used while responsibility for repairs is assessed under the rules of a different period. The Chicago & Alton in its statement pointed out that it was unable to secure the material for which to repair the car until January 4, 1930, when the repairs were made and the car was released. If it had had the proper material on hand to make repairs or had the material which the car owner furnished been received prior to January 1, 1930, there would have been no question as to its bill being correct.

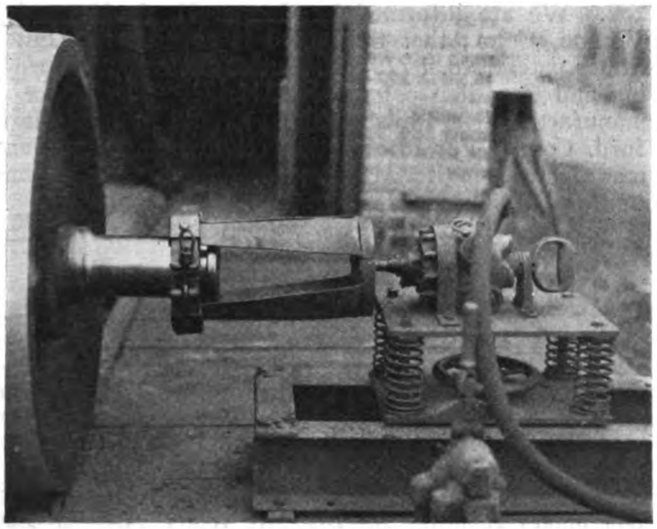
The Arbitration Committee in its decision stated: "Responsibility is governed by rules in effect at time of accident. Prices for repairs are governed by rules in effect on date repairs are completed. The position of the Chicago, Rock Island & Pacific is not sustained. Decision No. 1554 is parallel."—*Case No. 1672, Chicago, Rock Island & Pacific vs. Chicago & Alton.*

A Simple Method of Polishing Journals

A CAR foreman at one of the large western terminals has developed a simple and effective device for polishing journals on passenger-car wheels. Many methods have been used for performing this job but this one seems to be particularly interesting. The illustration shows quite clearly practically all of the equipment except a small air-cylinder turntable jack located in the floor between the rails which is used for turning the wheels end for end. The old style straight-air brake valve seen in the immediate foreground controls this jack.

The polishing machine consists essentially of a No. 2 air motor mounted on a spring platform which, together with a polishing head, is movable back and forth across the length of the journal. The spring platform is mounted on a roller carriage which runs on the lower flanges of a pair of eight-inch I-beams which form the stationary bed for the machine. The motor platform or carriage is in two parts, an upper and lower plate, with springs between and the height of the motor above the top of the rail is readily adjustable by means of a hand wheel.

The polishing head consists of two semi-circular shoes riveted to a hinged frame which permits the two shoes



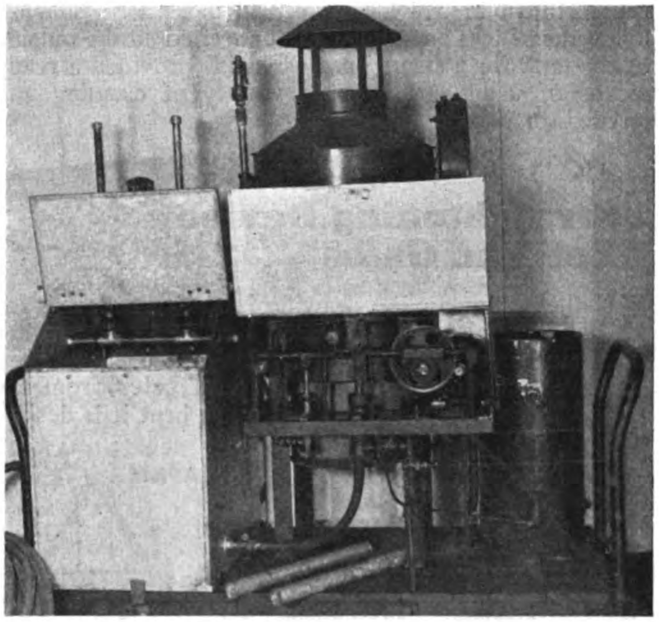
Abrasive cloth between two motor-driven shoes polish a journal in 20 min.

to be spread apart so that they may be slipped over the journal and adjusted to different sizes of journals. The preliminary polishing is accomplished by lining the shoes with No. 00 abrasive cloth and adjusting the pressure of the two shoes on the journals by means of clamp screws. Light oil is then applied to the journal, the motor started and the revolving shoes polish the journal as they are moved back and forth across its length. When the rough polishing is finished pieces of carpet cut to the proper size are substituted for the abrasive cloth and the journal is then given the finishing touches.

The entire operation on a normal journal requires from 15 to 20 min.

Truck for Steaming Water Containers

CONTAINERS used for drinking water on passenger cars have to be cleaned according to the sanitary code and on one railroad at least the job has been simplified by the construction of a compact and complete portable steaming outfit. The nucleus of this equipment was a commercial outfit, the Homestead Hypressure Jenny; which was originally used for steaming out garbage cans and containers from dining rooms and dining cars. The original commercial equipment consists of a flash type steam generator which is fired by an oil burner and is capable of generating steam at pressures up to 250 lb. per sq. in. The flash generator is fed with fuel oil and water by a pair of pumps ac-

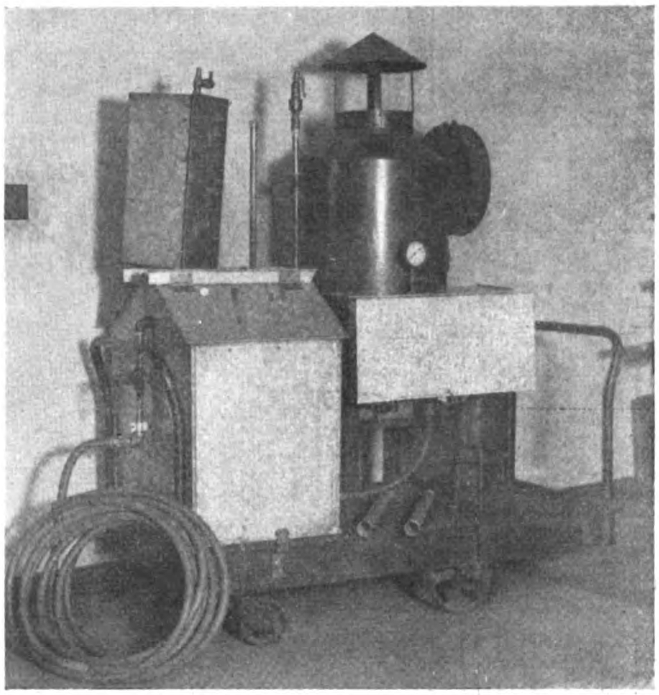


The flash boiler on this steaming outfit is fed with oil and water by motor-driven pumps

tuated by a beam which receives its motion from a cam on a gear wheel. The gear wheel is driven by a pinion on the shaft of a 32-volt motor. By using this type of electrical equipment the outfit is independent of city current supply and may be plugged into a receptacle on an electrically-lighted car.

As reconstructed for steaming water containers the outfit has a large water supply tank of galvanized iron, on top of which is a tray through which project two steam pipes from the generator. These pipes are drilled at intervals with small holes so that the steam under pressure is ejected in all directions. The water containers are placed on the pan over the pipes and the steam turned on by means of separate valves.

The steam supply line passes on through the water



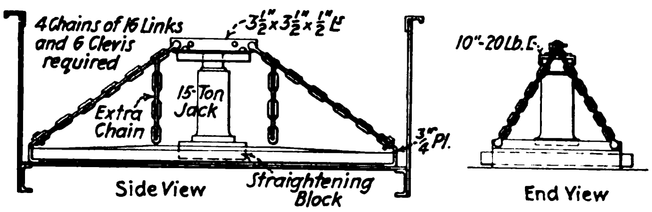
A view of the steaming truck with a water container in position

compartment in which the vertical pipes are taken off by means of tees and ends in a connection on the outside of the tank for a steam hose. Thus is provided a ready means of using steam for a variety of cleaning and sterilizing purposes.

through these holes, as shown. The bases of the columns are 12 in. by 12 in. and have four 13/16-in. cored holes for ¾-in. bolts or studs imbedded in the concrete foundation or floor. The roof is covered with asphalt roofing.

Straightening Device For End Gates

IN the accompanying drawing is shown a device for use in straightening pressed steel end gates, either the plain or corrugated types. This device can be used effectively without removing the end gates from the car. Where corrugated end gates are bent it is desire-

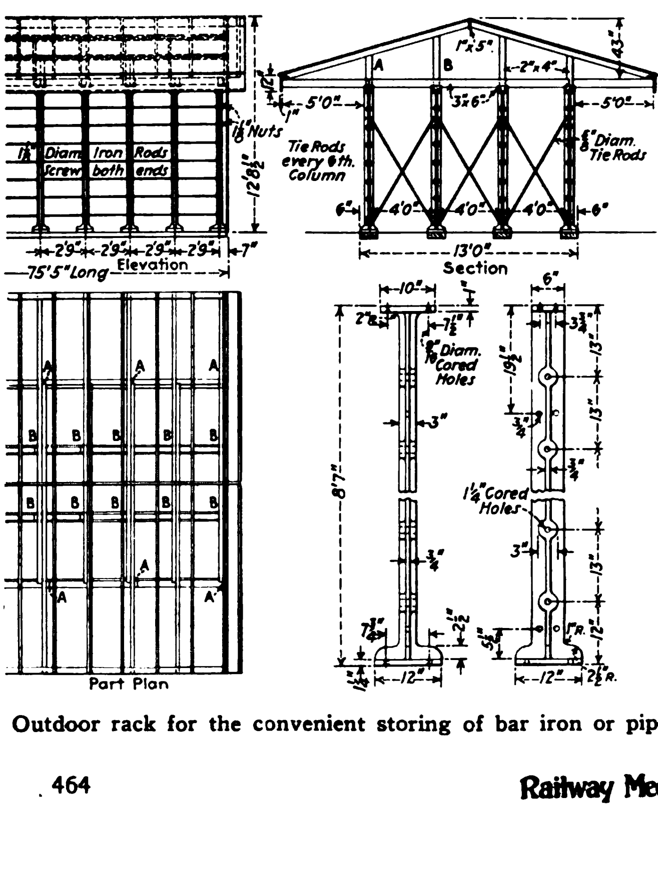


Details of a handy straightening device for end gates

able to set an oak block in the corrugation under the jack. This will permit the original contour to be maintained and no evidence of straightening can be detected. From 15 to 20 min. is all the time that is required to straighten up an end gate to its original shape and the end gates in both ends of the car can easily be straightened in about 30 min.

Rack for Storing Bar Iron and Pipe

THE rack shown in the drawing is used by an eastern railroad for storing bar iron and pipe. The columns are of cast iron with 1¼-in. cored holes spaced 13 in. apart. Rods 1⅛ in. in diameter are inserted



Outdoor rack for the convenient storing of bar iron or pipe

Stand for Repairing Distributing Valves

A DESCRIPTION of a stand for repairing triple and distributing valves was published in the May, 1931, issue of the *Railway Mechanical Engineer*, page 252. We are informed by George H. Andrews, Jr., Vernon, Conn., that this stand is covered by United States patent No. 1,729,812, United States patent pending and Canadian patent No. 311,171. The device is manufactured in Philadelphia, Pa., and in East Hartford, Conn. For information relative to its sale and manufacture, write Mr. Andrews at Vernon, Conn., or Box 847, Hartford, Conn.

Questions and Answers For Air-Brake Foremen

FOLLOWING is the third group of questions and answers selected from the instruction pamphlet recently revised by an eastern road:

Q.—What may cause leakage from the emergency exhaust port of an automatic brake valve when in lap position brakes applied? A.—Defective rotary valve or seat.

Q.—What may cause leakage from a straight-air brake-valve exhaust when brakes are applied in service? A.—Indicates that the double-seated check valve is leaking on the straight-air side.

Q.—What may cause leakage from the brake-cylinder exhaust of the distributing valve with brakes applied? A.—Defective distributing-valve exhaust valve.

Q.—What may cause an intermittent blow from the brake-cylinder exhaust of a distributing valve with brakes applied? A.—Indicates a weak or broken application-piston graduating spring, a defective distributing-valve gasket, high friction in the application portion, or application valve leaking.

Q.—What may cause leakage from the triple-valve exhaust with brakes applied? A.—A defective slide valve or seat.

Q.—What may cause leakage from an exhaust port of a brake-pipe vent valve with brakes applied? A.—A defective emergency slide valve, lower gasket or quick-action valve seat.

Q.—What may cause an intermittent or continuous blow at the distributing-valve brake-cylinder exhaust until brake-cylinder pressure is depleted? A.—A defective application-cylinder cover gasket, application-cylinder or chamber, application-cylinder pipe or fittings, independent-brake-valve lower gasket, defective independent or automatic rotary valve or seat and leaking distributing-valve equalizing slide or graduating valve.

Q.—Name some distributing valve defects which may prevent an application of brakes from a brake-pipe reduction of 5 lb. A.—A defective distributing valve, equalizing piston ring too loose in the groove or cylinder, or worn equalizing-piston cylinder bushing, feed groove too large, pressure chamber not fully charged or leaking, leaks from the application chamber, cylinder, pipe or connections.

Q.—Name some defects in a brake valve which may prevent brake application on a 5-lb. brake-pipe reduction. A.—Preliminary exhaust port restricted, resulting in slow rate of brake-pipe reduction; leaking automatic or brake valve rotaries; leaking bottom gasket independent brake valve, U pipe removed.

Q.—What happens if the application-cylinder and distributing-valve release pipes are crossed (No. 6 ET) with

the U pipe leaking or omitted? A.—Brakes will not apply.

Q.—What defects in A-1 or combined automatic and straight-air brake equipment may prevent brakes from applying on a brake-pipe reduction of 5 lb. A.—Auxiliary reservoir not fully charged or leaking; feed groove too large; leaking brake cylinder or related piping or defective brake-cylinder packing; restricted preliminary exhaust port (resulting in slow rate of brake-pipe reduction); leaking double-seated check valve (straight-air side); triple piston ring too loose in the groove or cylinder, or worn triple piston cylinder bushing; high friction in service parts; leaking high-speed reducing valve or safety valve.

Q.—What may cause an increase of equalizing-reservoir pressure with the automatic brake valve in lap position? A.—A leaking rotary or middle gasket of a six-position brake valve or leaking rotary or bottom gasket of a five-position brake valve.

Q.—What is indicated by a decrease of equalizing-reservoir pressure with the automatic brake valve in lap position? A.—A leak from the equalizing reservoir or the related piping, including the tube in the gage.

Q.—Will this condition cause the equalizing piston to lift and brake-pipe air to discharge through the service exhaust? A.—It may, unless the rate of brake-pipe leakage equals or exceeds the rate of equalizing-reservoir-pressure leakage.

Q.—What may happen on a light engine if the brake-pipe leakage is excessive with brake valves of the collapsible type? A.—Equalizing-reservoir pressure may force the equalizing piston of collapsible type down and allow pressure above the equalizing piston to reduce through the by-pass grooves.

Q.—How may the brake-pipe leakage be known on engines equipped with combined straight-air and automatic, or A-1 equipment. A.—By applying test device to brake-pipe hose coupling; then open the angle cock and read the gage after making required brake application and with the automatic brake valve in lap position. The drop in a given time will indicate the rate of brake-pipe leakage.

Q.—What may cause brakes to release with ET or EL equipment with the automatic brake valve in lap position and the independent-brake valve in running position following a 10-lb. service reduction? A.—Leaking application chamber or cylinder, application-cylinder pipe or connections, application-cylinder cover gasket or application packing cup or leather, defective distributing-valve gasket, defective automatic or independent rotaries or seats, or independent brake-valve lower gasket. In addition to the foregoing, a leaking distributing-valve equalizing or graduating valve, or increase of brake-pipe pressure may cause a release with No. 6 ET equipment (U pipe removed).

Q.—What may cause brakes to release with A-1 or combined straight-air and automatic equipment after a partial service brake application? A.—Leaking graduating valve or auxiliary reservoir, leak of main-reservoir air into the brake pipe due to a defective automatic rotary valve or seat, leaking brake cylinder or related piping, brake-cylinder pressure-head gaskets, packing cup or leather, double-seated check valve, high-speed reducing valve or safety valve.

Q.—What may prevent air from discharging at the independent brake-valve warning port with the handle in a release position? A.—Warning port may be obstructed, or it may be due to absence of pressure above the rotary valve.

Q.—Should air discharge from the brake-pipe vent valve with the automatic brake valve in service position? A.—Yes.

Q.—What may cause failure? A.—A loose emergency-piston ring or ball check not seating.

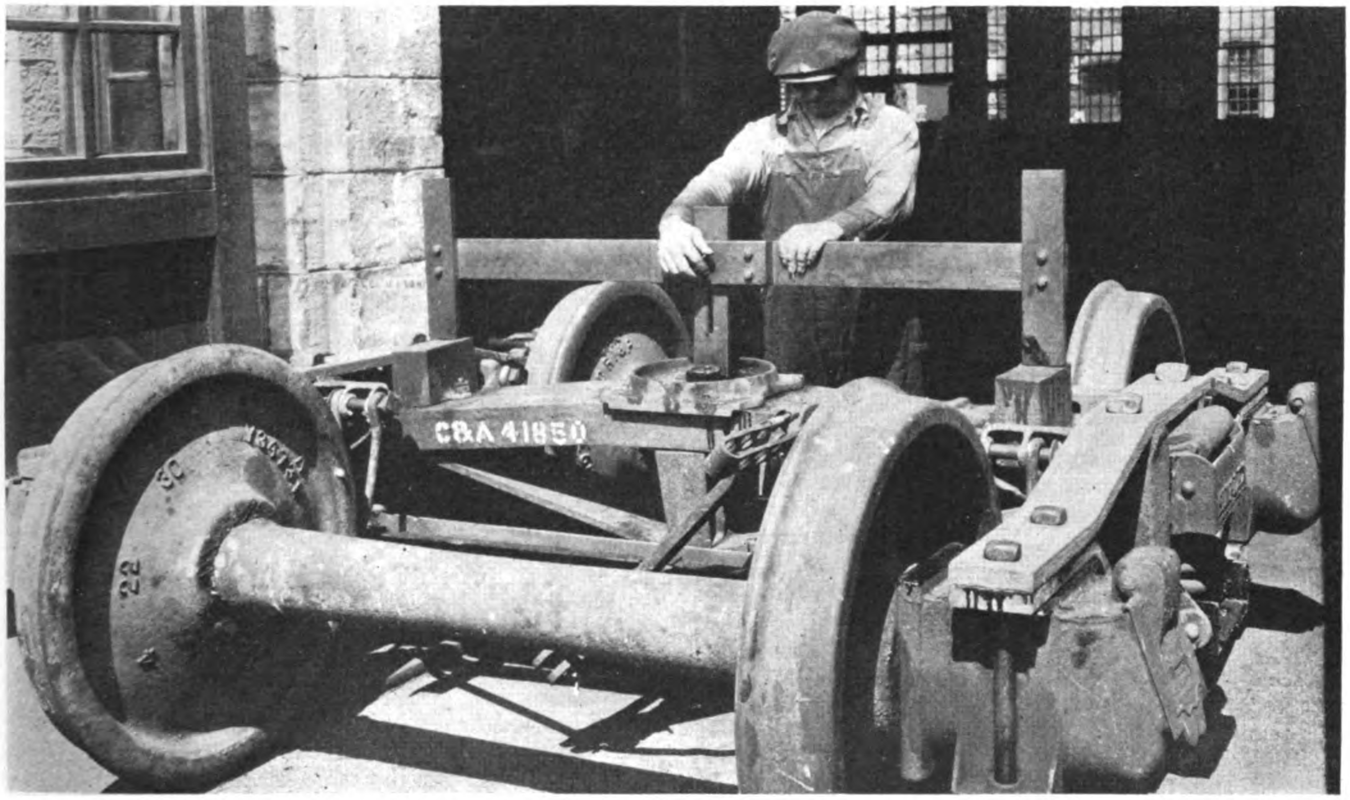
Q.—What may cause a vent valve to move to emergency position during a service reduction? A.—High friction of the emergency slide valve or piston, service port obstructed, or weak or broken emergency piston spring.

Q.—Explain how to determine if the application-cylinder pipe and distributing-valve release pipe are crossed. A.—Make a service brake application, place the independent-brake valve in release position. If pipes are crossed it will be impossible to release the brakes with the independent-brake valve following a service application.

Q.—What would be the result if the U pipe were removed or leaking? A.—With the independent brake valve in running position it would be impossible to make a service application.

Q.—How can it be determined whether or not the preliminary exhaust is of the proper size? A.—By charging the brake system; then make a 20-lb. reduction, which should require approximately 6, 8, and 10 sec. from an initial pressure of 110, 90 and 70 lb. pressure, respectively, with standard equalizing reservoir of 10 in. by 14½ in.

* * * *

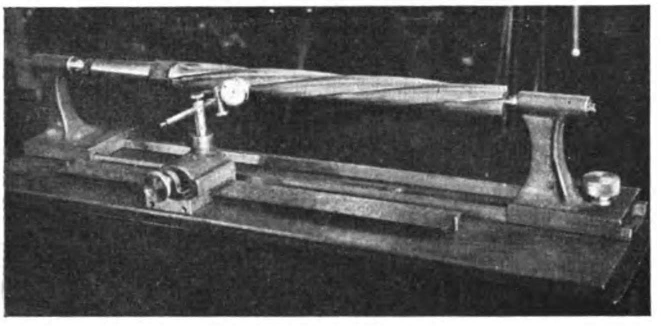


No measurements are necessary with this adjustable side bearing gage used at Chicago & Alton car shop, Bloomington, Ill., to assure the right amount of play on side bearings on first trial

In the
Back Shop and Enginehouse

A Simple Reamer Check

THE device shown was devised to check reamers and the bolts to be fitted to the holes reamed. The centers are permanently fixed at the standard taper and all reamers, before being issued from the tool room, are checked for accuracy by means of the gage indicator



A dial gage and permanent centers permit the accurate checking of reamers and bolts

mounted on a sliding carriage. The warping of a reamer in tempering or an error in taper are readily detected, the latter also being true of the bolt to be fitted.

Disputes as to where the errors occurred in ill-fitting bolts are reduced to a negligible point, as it is extremely difficult for a misfit to occur after both reamer and bolt have been subjected to this test. The centers, being permanently fixed, permit of no deviation such as may occur if they are adjustable and the greatest precision is insured.

Handling Shop Orders On the Norfolk & Western

THE Northern and Southern branch lines of the Norfolk & Western from Hagerstown, Md., to Winston-Salem, N. C., cross the main line at Roanoke, Va., thus making Roanoke the hub of the system and easily accessible to all shipping points and terminals. Consequently, more than the usual amount of manufacturing is done at Roanoke shops. The method of handling shop orders, described in this article, has been developed after considerable experimentation and has been found to be flexible and admirably suited to the requirements.

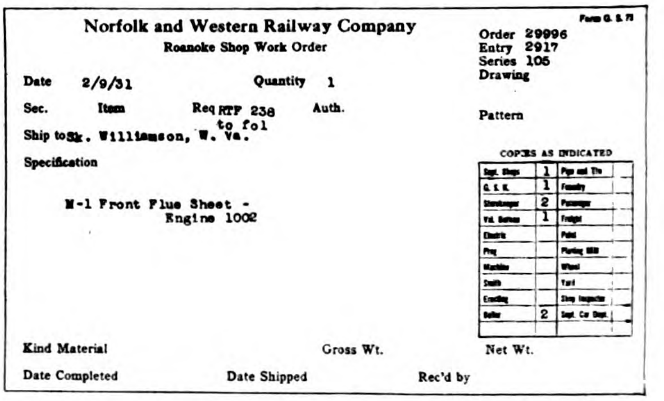
After passing through the proper channels for approval, all stock books for shop-made articles and requisitions for non-stock shop-made articles are turned over to a shop-order clerk who issues all orders for shop-manufactured materials. This clerk is familiar with the kind of material required for each item manufactured and the nature of the work that is to be performed on it. He sees that the orders are placed in each department concerned in the production of the material wanted, and arranges for the shops to be furnished with all necessary drawings and information.

The Norfolk & Western uses two kinds of orders, individual and standard. The individual orders are issued in sequence and cover items on which the exact cost of production is desired. Provision is made for all labor and material expended in manufacturing or repairing to be charged against each order, to which the shop expenses are added.

Standing orders are used for the manufacture of commonly-used materials for which an average cost is satisfactory. The standing-order accounts are closed out monthly and a six-month average cost found to be used for the succeeding six months. Any variation in the cost of manufacturing will be equalized over a six-months' period, and, in addition, will assure uniformity in prices.

Each order card, whether individual or standing, carries an entry number immediately below it which is for ready reference, especially in filing. Entry numbers are always in sequence. There are 10,000 entries in a series and when these are exhausted the next series is started with number one.

There are 102 standing orders covering the manufacture of frequently-used materials, several of which are shown for purposes of illustration:



Norfolk and Western Railway Company
Roanoke Shop Work Order

Order 29996
Entry 2917
Series 105
Drawing

Date 2/9/31 Quantity 1
Sec. Item Req RTF 238 to fol Auth.
Pattern
Ship to Sk. Williamson, W. Va.
Specification

N-1 Front Flue Sheet - Engine 1002

COPIES AS INDICATED

Kind Material Gross Wt. Net Wt.
Date Completed Date Shipped Rec'd by

The Norfolk & Western work order form

Order No.	Parts Manufactured
510	Cast steel, rough castings
511	Cast iron, rough castings
513	Bronze and brass rough castings
514	Miscellaneous forgings
516	Car forgings
517	Engine forgings
521	Rivets
530	Elliptical springs (manufacturing and repairing.)

The shop order cards are made of semi-stiff cardboard comprising ditto copies of Form GS73, illustrated. This form is a heavy, white paper, printed with copying ink. Blank shop order cards are available in three colors (all dittoed from the same form GS73) and include a buff for regular use, red for emergency or material needed at once, and yellow for special authority work.

The red, or emergency, card is given preferred attention by all departments, and the material rushed through with all possible speed. The yellow, or special authority, card is issued for new equipment on which special authority is required and is a safeguard against improper charges. As an additional safeguard, the order numbers of all special authority cards are prefixed by the letter "X."

The shop-order cards are issued to each department as required. If rough castings are ordered, three copies of the cards are sent to the foundry, one going to the pattern shop, one to the foundry office and one to the foundry shipping department. When the material is finished and ready for shipment, it is turned over to the storehouse and the foundry takes a receipt for the material delivered.

If two or more departments participate in the manufacture of an item, the originating department takes a receipt on turning the material over to the intermediate or finishing department. The originating department sends its card to the shop-order clerk who makes a note of the date and in this way can keep in touch with the progress of the material through the shops. When the finishing department delivers the material to the stores department, a final closing card is given to the shop-order clerk who forwards it to the office of the shop superintendent when the shop accounting is done. From this office, all charges are made and the general storekeeper is billed with the cost of production. These charges are carried in the M. & S. account until the material is shipped or issued to the user and the M. & S. account cleared. Copies of standing orders are not sent to the office of the shop superintendent as the labor and material expended on these orders are taken from individual time cards.

Prony-Brake Arrangement For Testing Air Motors

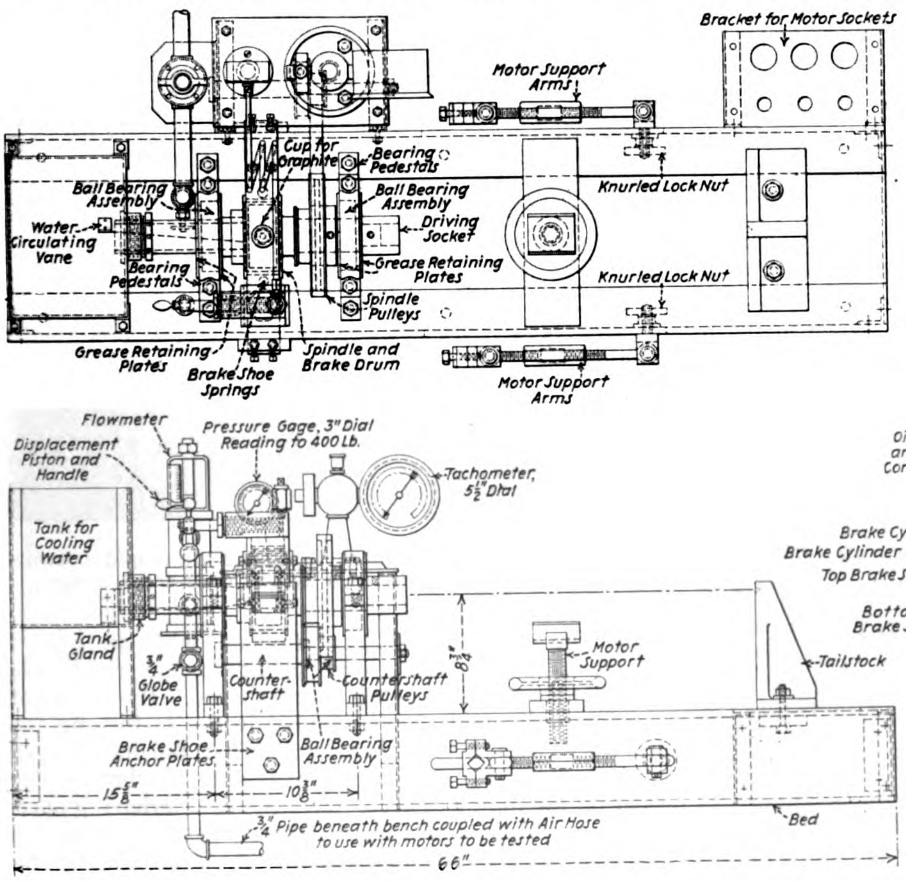
ONE of the important jobs in a tool room or shop test department is the testing of compressed-air tools to ascertain that each motor operates at its rated capacity with respect to output and air consumption. The prony-brake arrangement shown in the drawing is used for testing the motors of compressed-air tools.

The motor is placed on the motor support between the two support arms and ahead of the tail stock. Both the support and support arms are designed for close adjustment. The tail stock is clamped to the bed and can also be adjusted to suit the size of the motor.

It is connected to the driving socket which operates the spindle to the pulley for driving the tachometer and also the prony-brake drum. The brake shoes are lubricated with graphite, as shown. Provision is also made for the circulation of cooling water.

The prony-brake arm exerts pressure on the brake-cylinder piston. This pressure is registered on the air-pressure gage, which shows readings up to 400 lb. The tachometer has a 5½-in. dial and shows the instantaneous speed of the motor at speeds from 100 to 1,000 r.p.m. Compressed air to the motor from the shop air line passes through a flow meter which measures the quantity of air consumed by the motor. Provision is made for regulating the amount of air displaced from the air cylinder by means of a displacement piston and handle, as shown.

The countershaft is used when testing slow-operating motors. With this belt arrangement, the tachometer reading is divided by four. When fast-operating motors are being tested, the belt drive is made directly from the brake spindle to the tachometer. The area of the



Apparatus for testing air-operated motors in the shop

brake cylinder is 5 sq. in. To ascertain the force exerted by the brake arm on the air-cylinder piston, the air-gage reading is multiplied by 5.

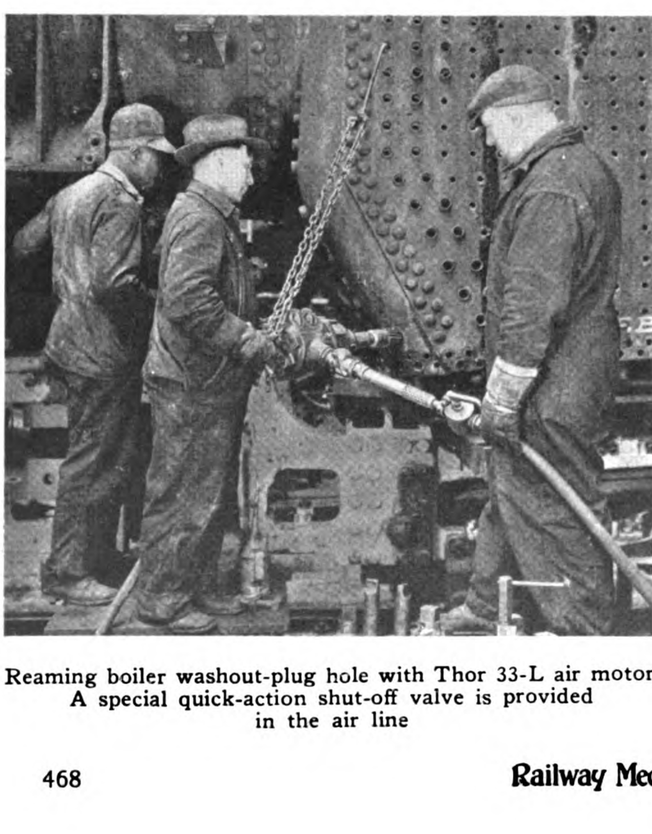
Set screws are provided to adjust the brake shoes on the drum. These screws should be adjusted so that the top and bottom shoes are clear of the drum when there is no pressure on the brake.

The flowmeter used with this equipment is manufactured by the New Jersey Meter Company, Plainfield, N. J., and the tachometer is a Columbia speed recorder manufactured by Fairbanks, Morse & Co., Chicago. The ball-bearing assemblies used on the brake-spindle bearings are from a Stone-Franklin car generator type No. 50, while the bearing assemblies for the countershaft are from a No. 4 Little Giant compressed-air grinder.

Two Boiler-Shop Devices

SHOP devices which contribute either to safety or increased production are always welcome in the boiler shop and of general interest to boiler-shop foremen and supervisors. The first of those illustrated in this article comprises a special valve inserted between the air hose and the motor operating handle to permit shutting off the motor instantly, in case of necessity, while reaming and tapping mud-plug holes or blow-off cock holes. The reversible compound piston-type air motor is suspended at the proper elevation by means of a chain and hook inserted in a flexible staybolt hole, as this type of motor weighs about 54 lb. A long dead lever is used, being held by a helper to prevent the motor getting away from the operator in case of sticking, which is always more or less of a possibility with large holes such as this 2¼-in. mud-plug hole.

The additional control valve, plainly shown in the illustration, is a spring-lever valve which remains open only while the handle is pressed down by the helper at the right, and closes instantly on release of the lever in case the large reamer or tap gives any indication of sticking. The closing of this valve shuts off the supply of air to the motor immediately and stops the motor even quicker than could be done by the use of the usual handle control valve.



Reaming boiler washout-plug hole with Thor 33-L air motor. A special quick-action shut-off valve is provided in the air line

With this method of operation and arrangement of the motor the boiler maker in the center is left free to devote his entire attention to lining the motor up properly and making sure that the reaming or tapping operation proceeds at the proper rate for the best results.

Special Lever Feeding Arrangement

The second illustration shows the use of a Thor No. 9 close-quarter air drill in countersinking rivet holes in the flange of a fire-door sheet, using a special U-shaped hook-and-lever arrangement for feeding the drill. As illustrated, this device consists of a U-shaped forging, the two legs of which are about 24 in. apart and 10 in. long, the outer one being provided with an inward horizontally projecting end to fit in the rivet hole adjacent to the one being counterbored. By means of the long adjustable lever, pivoted in the U-forging and provided with a head bearing against the motor feed screw, sufficient pressure can readily be brought to bear on the motor to accomplish the counterboring operation quickly. The feeding device is then moved to the next hole easily and without any loss of time. By means of the bolt and four holes shown in the U-shaped forging, this device can be quickly adjusted for use with different sizes of motor or different lengths of counterboring tool.

A special lever arrangement facilitates the rapid countersinking of rivet holes in a firebox door-sheet flange

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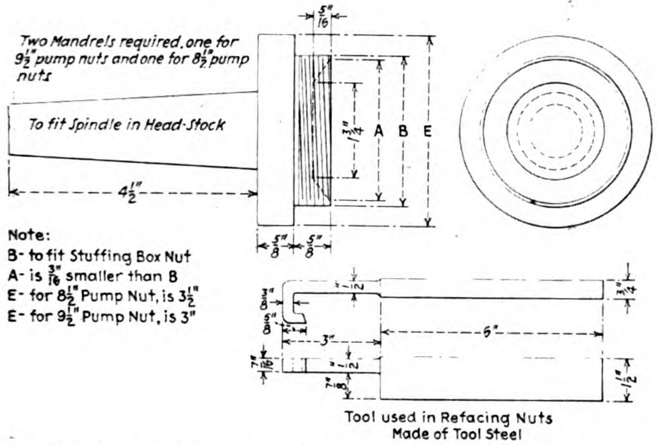
Twenty-Five Years Ago.—The Master Car Builders Association has adopted a rule which requires that all cars offered in interchange after September 1, 1907, must be equipped with air brakes. The Interstate Commerce Commission has issued an order that the minimum percentage of air braked cars in trains used in interstate commerce shall be increased to 75 per cent on and after August 1, 1906.—Railway Age, November 24, 1905.

Reclaiming Stuffing-Box Nuts on Compressors

By E. G. Jones

STUFFING-BOX nuts which are used repeatedly during the operation of air compressors finally become grooved and shouldered and are in many cases thrown into the scrap pile. This is a waste of material, for they can be easily and accurately reclaimed.

The nut is screwed on the mandrel and is refaced from the inside by the reversed facing tool as shown. A nut



Mandrel for reclaiming stuffing-box nuts on air compressors

does not require much facing to reclaim it and it is no difficult task to accomplish with this mandrel and tool. The life of a stuffing-box nut in many instances is doubled and sometimes tripled.

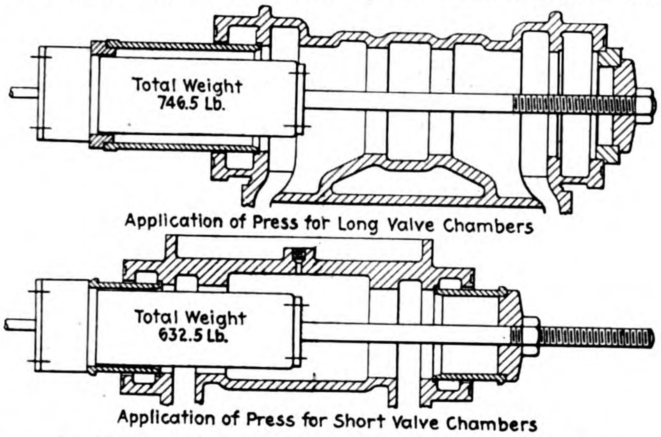
If the face of a stuffing-box nut is not in alinement with the threads, it will cause considerable leakage by the metallic packing where it is intended to make a seal. If the nut is grooved and shouldered, this leakage is obviously great and the method shown of reclaiming these nuts eliminates this undue leakage by properly alining the new face with the threads in the nut.

The mandrel is made of steel and the tapered end is made to fit the spindle in the head stock of a lathe. The nut is screwed on the mandrel and strikes the shoulder of the mandrel, which leaves enough space between the mandrel and the face which is to be reclaimed that the tool may be entered.

Where 8½-in. and 9½-in. air compressors are maintained, two mandrels are required.

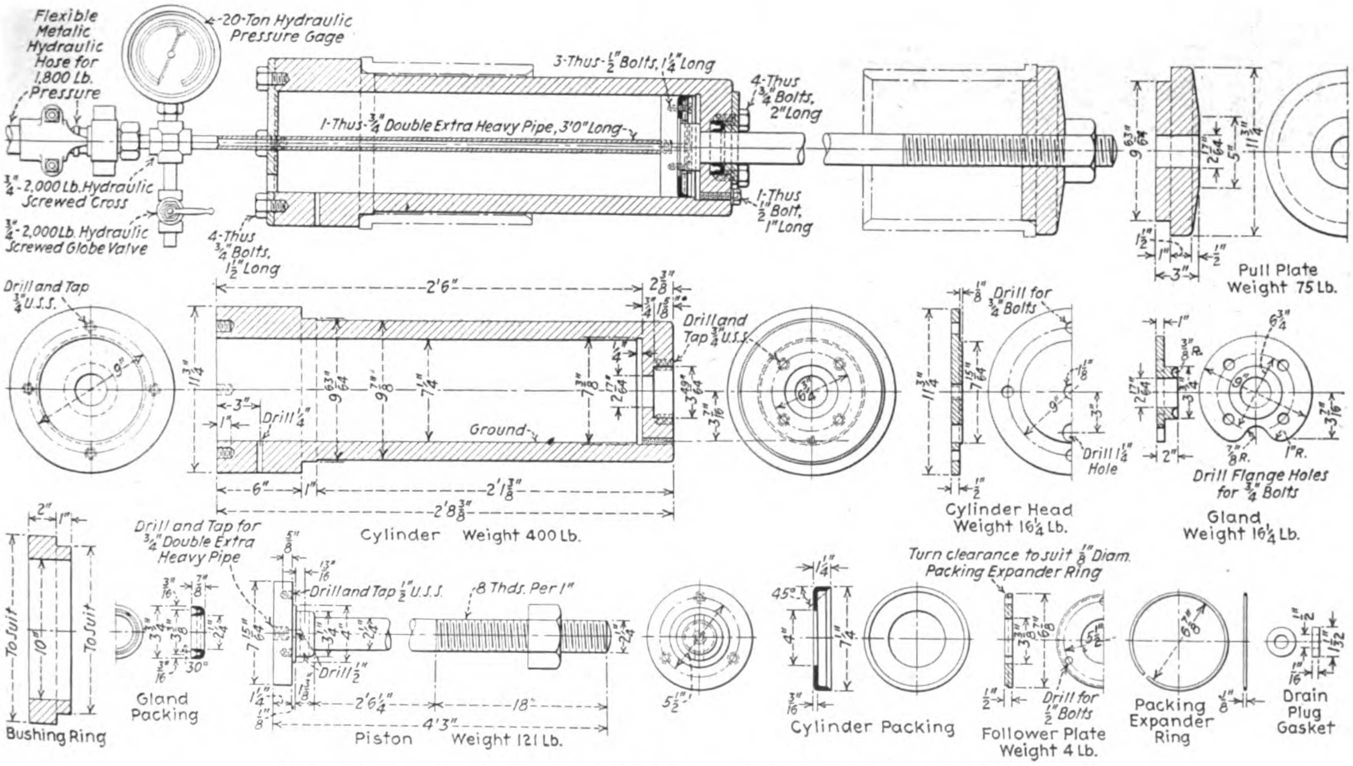
Hydraulic Press for Pulling Valve Bushings

THE hydraulic press, the details and application of which are shown in the two drawings, is one of the standard shop devices used by an eastern road. The



Application of the hydraulic pulling press for short and long valve chambers

cylinder is of axle steel, bored 7¼ in. diameter. The piston and piston rod, as well as the various small parts,



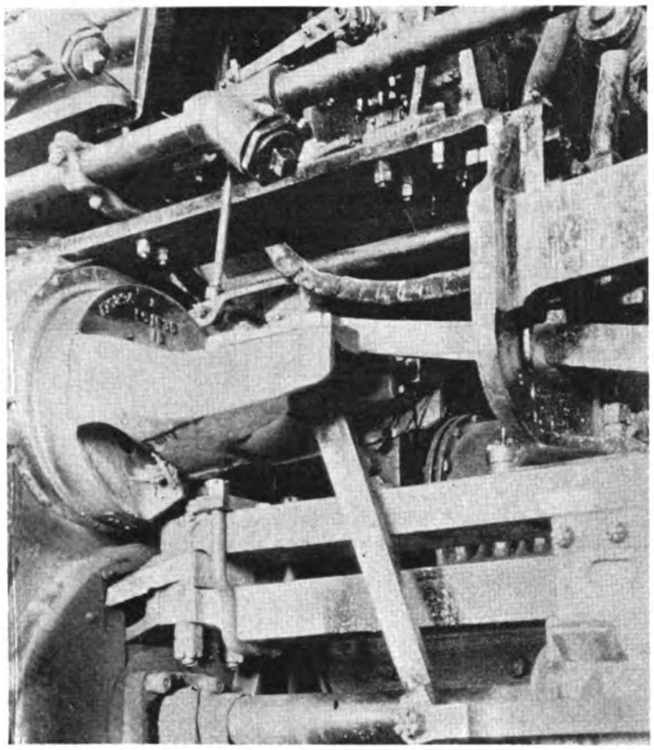
Assembly and details of the hydraulic press for pulling in valve bushings

are of machine steel. The drain-plug gasket is of copper. Leather is the material used for the cylinder packing cup.

This press may be used for pulling the bushings in valves having long or short chambers. In the case of a long valve chamber, a bushing ring is provided, which is placed over the cylinder, as shown.

Convenient Drive for A Mechanical Lubricator

SHOWN in the illustration is a neat arrangement for operating a mechanical lubricator. An extension plate is welded to the top of the combination lever and extends a few inches in front of the center line of the lever. As the lever rocks back and forth, sufficient vertical movement is imparted to the arm of the mechanical lubricator through the short arm shown.

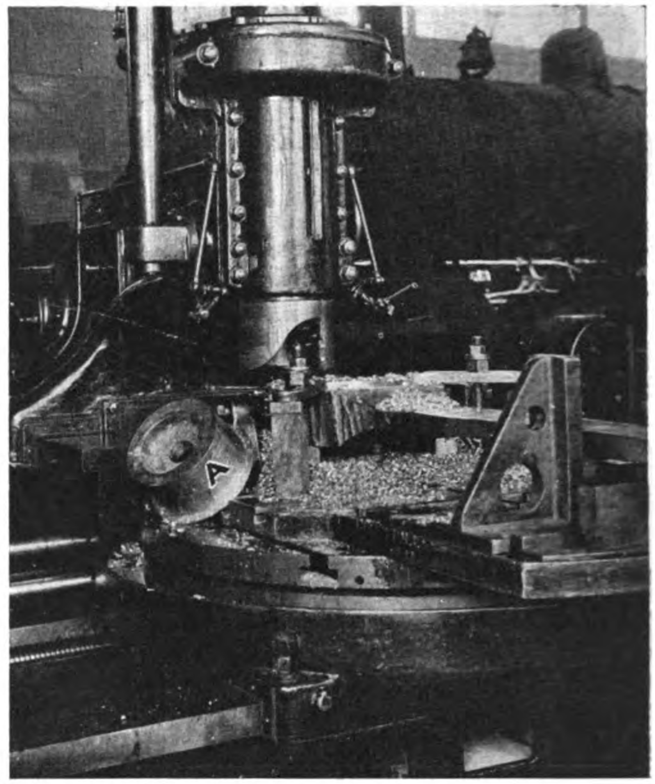


Application and drive for mechanical lubricator

There are of course numerous satisfactory locations and methods of coupling up these lubricators depending on the arrangement of other parts of the design. The drive is usually off the valve crosshead or combination lever. No special bracket is required for the class of engine shown. The lubricator is mounted on the guide-yoke brace.

Trepanning Side Rods

THE practice generally employed in boring side rods for the reception of the bushing, is first to perforate with a drill of medium size, followed by successive drills of larger size until the hole is adequate to accommodate a boring bar, which by successive cuts, reaches the finished size. The core marked *"A"* to the left of the illustration is evidence of the efficiency of this trepanning tool and was cut out in 50 min. flat or just 3 hr. 10. min. less than under the former method described.



Trepanning out the piece marked A completed in 50 min.

The trepan is simply a cylindrical cutter with three teeth having but slight clearance for chips and is shown operated by an Ingersoll vertical milling machine.

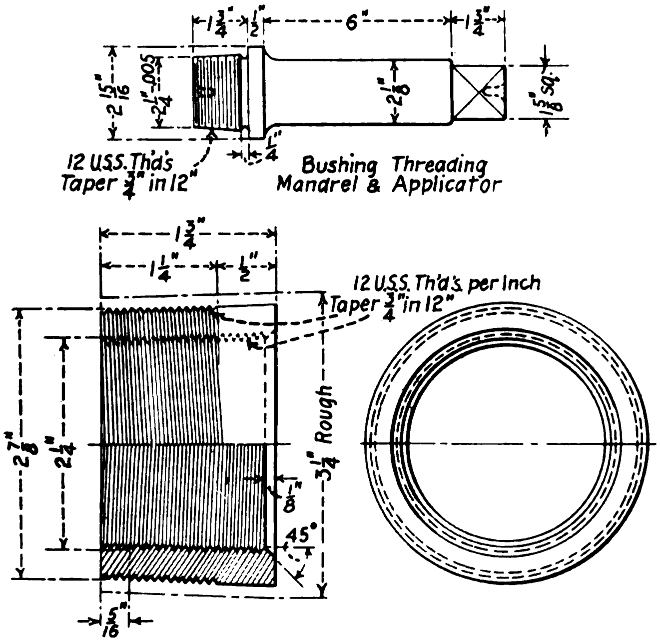
Blow-Off Cock Application

WHILE there is a decided tendency towards the use of flanged blow-off cocks on steam locomotives, many with threaded applications are still in service, and these threaded connections must be maintained in a safe and serviceable condition during the remaining effective life of the blow-off cocks.

The repeated removal and re-application of blow-off cocks has a tendency to produce thread wear and, moreover, boiler sheets frequently become thin inside the water leg and around the blow-off cock holes, to such an extent that the number of full holding threads is reduced and a potential hazard created. To overcome this condition, one road developed the steel bushing illustrated. This bushing is made of open-hearth steel, finished all over and machined with 12 U. S. threads per inch and a taper of ¾ in. in 12 in., both inside and out. The smallest diameter of the bushing where it enters the boiler sheet is 2⅞ in., and the smallest diameter which receives the threaded end of the blow-off cock is 2¼ in. Enlargment of the blow-off cock hole in the boiler sheet to receive the bushing is usually adequate to cut away entirely the thinned portion of the sheet and provide practically the original sheet thickness in which the full number of new threads can be cut to receive the bushing. A fillet of electric-welded metal is then

applied between the boiler sheet and the bushing, which greatly strengthens the construction and prevents the bushing from backing out when the blow-off cock is being removed.

The bushing illustrated is made from 3½-in. tubular open-hearth steel stock threaded on the interior diameter



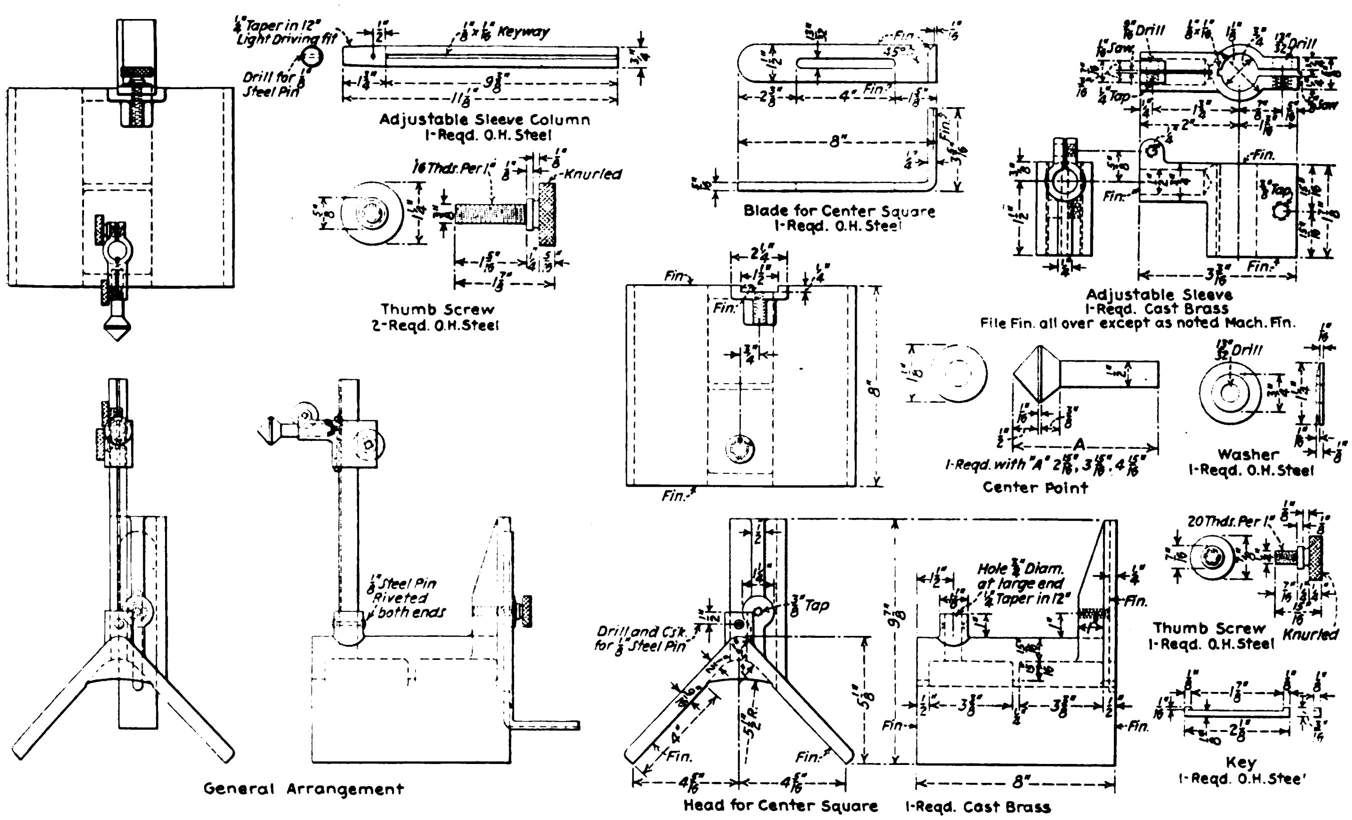
Details of a bushing used for the improved application of screw-type blow-off cocks

and cut off to the required length in a turret lathe. The mandrel illustrated in the upper right corner of the drawing is then threaded into the bushing and used to support it in an engine lathe, while the outside of the bushing is being cut to the required taper and threaded. The mandrel is provided with centers and one end cut to a square to receive the lathe dog used in the turning operation. This mandrel also proves very useful in applying the bushing to the boiler sheet, assuring that this will be done without damage to the bushing. The design of the mandrel is such that it can be used to turn the bushing solidly into place, a reverse movement readily releasing it, since the shoulder prevents any binding on the threads.

Locating the Center Line Of a Locomotive Crank Pin

SHOWN in the drawing are the details and general arrangement of a center square for locating the center line of the crank pin on the driving-wheel axle. The head and adjustable sleeve are of cast brass, the latter being file finished all over except where marked on the drawing for machine finish. The remaining parts are of steel.

TIMEKEEPERS on the Italian State Railways, it would seem, must be expert mathematicians, certainly with some knowledge of calculus. They need it to figure the rates of pay of enginemen and firemen. As explained by an Italian road foreman of engines, there is a basic rate for these men. This is subject to a percentage increase for every five years of satisfactory service. To this rate is added the working rate, which is based on the number of kilometers run and the time consumed in making the run. A further percentage is added for fuel economy, together with additional pay for night operation. In freight service, the tonnage handled is also taken into consideration. The rates of pay in engine service run from 1,200 lire to 2,100 lire per month, the lire being quoted at five cents, United States money. These involved calculations are a part of the general plan on the Italian railways to bring about orderliness and efficiency in operation, a plan which is proving more successful each year.

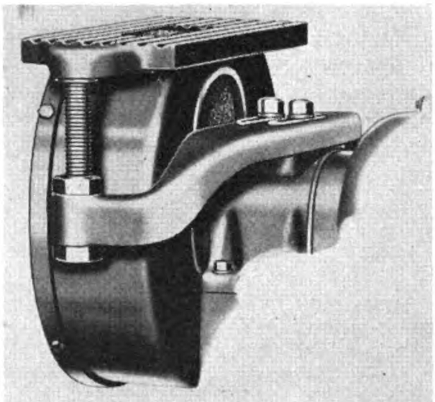


Center square for locating the center line of the crank pin on the driving-wheel axle

NEW DEVICES

Surface-Grinding Attachment

The Hisey Wolf Machine Company, Cincinnati, Ohio, has recently placed on the market a surface-grinding attachment for floor grinders which may be interchanged with the standard wheel



Hisey-Wolf surface grinding attachment which interchanges with the wheel guard

guard equipment on either side of the machine. The table is adjustable to the wear of the wheel through two square-thread screws which are locked rigidly in place by means of two opposed nuts. The guard cover is readily removable for the replacement of the wheel. The table is 10 in. by 21 in. and is self-cleaning. Both the guard and the cover on the attachment are of steel.

Kendall Journal Lubricator

The Kendall journal lubricator, illustrated, has been developed by the Railway Products Company, 5949 W. Superior street, Chicago, and tested during the past two years in both passenger and freight service. Experimental applications have also been made to provide lubrication for locomotive main driving journals, the performance record generally indicating a high degree of reliability and improved lubrication with about one-third of the ordinary oil consumption.

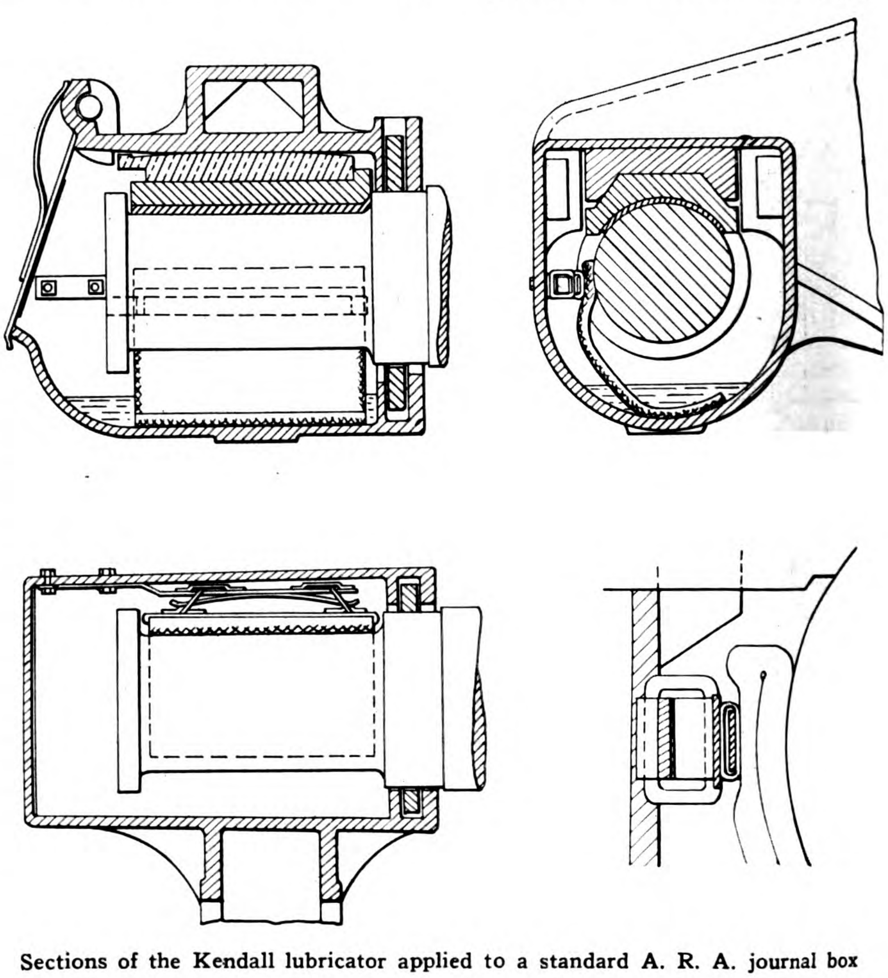
The lubricator consists of a specially-woven cotton pad, approximately as wide as the journal and 3/8 in. thick, supported by spring tension against the journal at the level of the center line and long enough to extend down to the bottom of the journal box which forms a reservoir for a small amount of car oil, fed by capillary attraction to the journal, as needed for lubrication. All of the materials entering into the construction of this lubricator are relatively inexpensive to procure and the device can be quickly and easily applied to the interior of any standard journal box. The lubricating pad is secured to a brass strip which is in turn locked to a pressure bar, flexibly spring supported from another small bar rigidly held in the journal box by two small bolts. The connection is sufficiently flexible to allow the lubricating pad to follow any normal end movement of the journal in the box and it does not interfere in any way with jacking the box for the examination or renewal of brasses. This type of construction is designed to do away with the possibility of "waste grabs" and provide an effective supply of lubricant to the journal at small expense for initial application and with substantially less subsequent inspection and attention to secure freedom from hot boxes than would be the case with oil and waste packing ordinarily used in standard A. R. A. journal boxes.

The Kendall journal lubricator is now in test service on 10 roads, the original installation having made over 240,000 miles since first being placed in through passenger-coach service in June, 1929. Experience with these tests is said to have indicated an entire freedom from failure due to "glazing," the presence of dirt, water, snow or ice in the box, or the accumulation of lint working under the brass to cause a hot box. Terminal attention to these lubricators has been minimized and confined to the application of a small amount of oil at infrequent intervals. One road reports 2,000 miles per pint of oil per box; another reports 100,000 miles on 26.38 pints of oil, or about 3,800 miles per pint per box. A third road, however, which installed eight test boxes on a passenger car in April, 1931, reports that the car made 10,098 miles in the next three months without the addition of any extra oil. Kendall lubricators, which had previously been in service for a year and covered more than 100,000 miles, were applied to four journal boxes and sealed during a 30-day test, in which an oil consumption of .01687 ounces per mile per journal was reported, as compared with .05968 ounces per mile per journal for A.R.A. packed bearings, or a saving of almost 72 per cent in oil consumption alone.

Duff-Norton Aluminum Alloy Jacks

The Duff-Norton Manufacturing Company, Pittsburgh, Pa., has recently placed on the market a ball-bearing journal jack

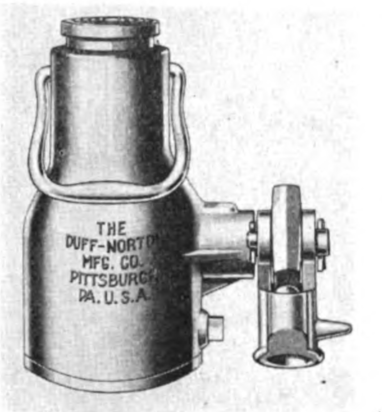
(Continued on next left-hand page)



Sections of the Kendall lubricator applied to a standard A. R. A. journal box

of the car-inspector type with a one-piece "Alcoa" aluminum-alloy shell. The new jacks are furnished in two capacities—15 and 25 tons—and the total weight is 19 and 26 lb., respectively. Both sizes are 10 in. high and have a 5-in. lift.

The special features of these jacks are the one-piece aluminum alloy shell, a

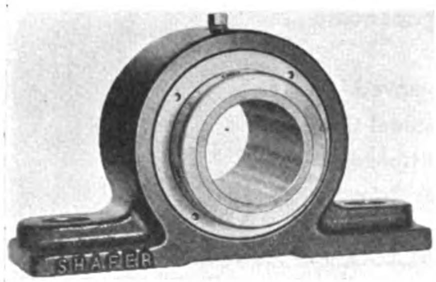


The aluminum-alloy jack of 15-ton capacity weighs only 19 lb.

lifting standard of cold-drawn seamless steel with a forged-steel top and a special positive stop safety feature. The special safety stop prevents the lifting standard from being run out of the base.

Shafer Roller-Bearing Units

An entirely new line of Shafer self-alining roller bearing units for normal duty applications has recently been announced by the Shafer Bearing Corporation, Chicago. Shafer double-row self-alining roller bearings as used in the



A pillow block fitted with Shafer self-alining roller bearing

standard-duty units are now available in these lighter, compact housings. The normal-duty units are furnished as pillow blocks, flange units, and take-up units, in a full range of shaft sizes from ¾ in. to 3 in.

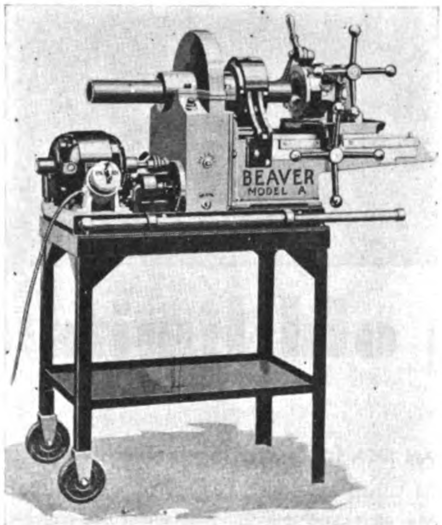
The inner race of the bearing is extended on one end only and fastened to the shaft by a special locking collar, providing ample capacity for the intended service and a simplified application of the unit on the shaft. The sealing of the normal duty unit is accomplished by a grease seal consisting of two steel stampings pressed into the housing or cover. Between these stampings is a 3/32-in. fibre washer which is a slip fit on the extended cone. The seal effectively excludes dirt and other abrasive materials, retains lubricant and prevents leakage.

The flange unit may be bolted to the side of a machine frame of cast iron or structural steel without machining, as the self-alining feature compensates for moderate inaccuracies of mounting. It can also be used as a step bearing for vertical shafts. Three bolts are used on the smaller sizes, and the larger units require four.

The new Shafer take-up units are suitable for conveyor work or any normal-duty applications.

Beaver Model A Pipe Machine

The Borden Company, Warren, Ohio, has recently developed a new model of the Beaver portable pipe machine. This model known as "A," is designed to cut,



The opening head makes it unnecessary to back the dies off finished threads

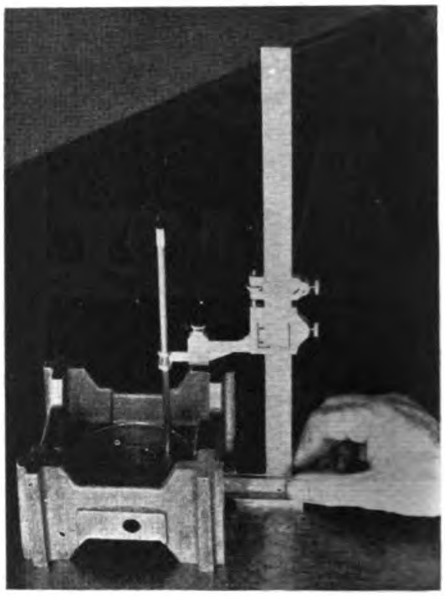
thread and ream steel, wrought-iron, brass or cast-iron piping in sizes from ½ in. to 2 in. Three opening die heads are supplied—½ in. by ¾ in.; 1 in. by 1¼ in.; and 1½ in. by 2 in. The dies are adjustable for oversize, undersize or standard. It is not necessary with this design of machine to back the dies off over finished threads. By means of the lever at the top the head may be opened. The die head may be tilted back out of the way (it is not necessary to take it off) when cutting or threading up to 12-in. pipe using a universal shaft and die stocks and pipe cutters.

This model of Beaver pipe machine has a ½-hp. motor which is reversible at the switch and is connected with flexible coupling. The electrical equipment operates on 110-volt light current. All of the main housings of the machine are made of aluminum which contributes to a great saving in weight. An oil pump on the machine is mounted on the outside where it is readily accessible for repacking and cleaning when needed.

Bolt die heads can be furnished for use in this type of machine.

New Height Gage Attachment

The Brown & Sharpe Manufacturing Company, Providence, R. I., has recently announced new depth gage attachments No. 585A and 585B for use with vernier



The B. & S. depth gage converts the vernier height gage to a depth gage

height gages No. 585 in both the 10-in. and 18-in. heights.

The attachment is easily locked in place on the vernier by means of a clamp screw. The application of the attachment to the vernier height gage quickly converts this tool into a reliable and accurate depth gage. Measurements can be taken accurately over high projections and in deep recesses.

(Turn to next left-hand page)

A mixed train on the Buffalo & Susquehanna near Nelson Run, Pa.

Among the
Clubs and Associations

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—The business session of the Fuel Association scheduled for September 15 and 16 at the Hotel Sherman, Chicago, has been cancelled. Programs for this meeting were being distributed when the decision to cancel the meeting was made.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—T. W. Demarest, general superintendent. Pennsylvania, will discuss Car Department Problems at the September 14 meeting of the Car Foremen's Association of Chicago which will be held at 8 p.m., at the Great Northern Hotel, Chicago.

CANADIAN RAILWAY CLUB.—At the meeting of the Canadian Railway Club which will be held on September 14 at 8 p.m. at the Windsor Hotel, Montreal, Mr. Norman, chairman of the Industrial Commission on Unemployment, City of Montreal, will discuss What the City of Montreal Has Done for Unemployment. Moving pictures will describe the work.

AMERICAN SOCIETY FOR TESTING MATERIALS.—The A.S.T.M. Committee B-7, whose chairman is J. B. Johnson, chief material section, Materiel Division, Air Corps, U.S.A., Wright Field, is contemplating the preparation of specifications for aluminum alloys in the form of forgings suitable for engine crankcases, locomotive parts, and miscellaneous forgings. The committee is also arranging to carry on a series of tests to ascertain the best methods of determining the proportional limit for cast and wrought light alloys.

NATIONAL SAFETY COUNCIL.—During the week of October 12 to 16 representatives of transportation companies will meet at the Stevens Hotel, Chicago, to consider practical ways and means to reduce accidents and accident costs. The program of this Twentieth Annual Safety Congress and Exposition will be conducted by the Steam Railroad, Electric Railway, Marine and Aeronautical Sections of the National Safety Council. Standard safety equipment and latest developments in safety appliances will be displayed at the exposition. The Safety Congress will have a total of 130 sessions in 45 different divisions.

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

ALLIED RAILWAY SUPPLY ASSOCIATION.—F. W. Venton, Crane Company, Chicago.

AMERICAN RAILWAY ASSOCIATION.—DIVISION V.—MECHANICAL.—V. R. Hawthorne, 59 East Van Buren street, Chicago. Meeting June 23, 24 and 25, Congress Hotel, Chicago.

DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey street, New York. Next meeting May 19, 20, 21, Biltmore hotel, Atlanta, Ga.

DIVISION I.—SAFETY SECTION.—J. C. Caviston, 30 Vesey street, New York.

DIVISION VIII.—CAR SERVICE DIVISION.—C. A. Buch, Seventeenth and H. streets, Washington, D. C.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.

RAILROAD DIVISION.—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York.

MACHINE SHOP PRACTICE DIVISION.—Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.

MATERIALS HANDLING DIVISION.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.

OIL AND GAS POWER DIVISION.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.

FUELS DIVISION.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa.

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

CANADIAN RAILWAY CLUB.—C. R. Crook, 2276 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month except in June, July and August, at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT OFFICERS ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 2514 West Fifty-Fifth street, Chicago. Regular meeting, second Monday in each month except June, July and August, Great Northern Hotel, Chicago, Ill.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 608 South Main street, Los Angeles, Cal. Meetings second Monday of each month except July, August and September, in the Pacific Electric Club building, Los Angeles, Cal.

CAR FOREMEN'S ASSOCIATION OF OMAHA, Council Bluffs and South Omaha Interchange.—Geo. Kriegler, car foreman, Chicago, Burlington & Quincy, Sixteenth avenue and Sixth streets, Council Bluffs, Iowa. Regular meetings, second Thursday of each month at Council Bluffs.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—F. G. Weigman, 720 North Twenty-third street, East St. Louis, Ill. Regular meeting first Tuesday in each month, except July and August, at American Hotel Annex, St. Louis, Mo.

CENTRAL RAILWAY CLUB OF BUFFALO.—T. J. O'Donnell, executive secretary, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meeting, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

CINCINNATI RAILWAY CLUB.—D. R. Boyd, 453 East Sixth street, Cincinnati. Regular meeting second Tuesday, February, May, September and November.

CLEVELAND RAILWAY CLUB.—F. L. Frericks, 14416 Adler avenue, Cleveland, Ohio. Meeting second Monday each month, except July, August and September, at the Auditorium, Brotherhood of Railroad Trainmen's building, West Ninth and Superior avenue, Cleveland.

EASTERN CAR FOREMEN'S ASSOCIATION.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings fourth Friday of each month, except June, July, August and September.

INDIANAPOLIS CAR INSPECTION ASSOCIATION.—E. A. Jackson, Box 22, Mail Room, Union Station, Indianapolis, Ind. Regular meetings first Monday of each month at Hotel Severin, Indianapolis, at 7 p.m. Noon-day luncheon 12:15 p.m. for Executive Committee and men interested in the car department.

INTERNATIONAL RAILROAD MASTER BLACKSMITH'S ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash street, Winona, Minn.

LOUISIANA CAR DEPARTMENT ASSOCIATION.—L. Brownlee, 3730 South Prieur street, New Orleans, La. Meetings third Thursday.

MASTER BOILERMAKERS' ASSOCIATION.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

MASTER CAR BUILDERS' AND SUPERVISORS' ASSOCIATION.—See Car Department Officers Association.

NATIONAL SAFETY COUNCIL—STEAM RAILROAD SECTION.—W. A. Booth, Canadian National Montreal, Que. William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting, second Tuesday in each month, excepting June, July, August and September. Copley-Plaza Hotel, Boston.

NEW YORK RAILROAD CLUB.—Douglas I. McKay, executive secretary, 26 Cortlandt street, New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York.

PACIFIC RAILWAY CLUB.—W. S. Wollner, P. O. Box, 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

PUEBLO CAR MEN'S ASSOCIATION.—I. F. Wharton, chief clerk, Interchange Bureau, Pueblo, Colo.

RAILWAY BUSINESS ASSOCIATION.—Frank W. Noxon, 1124 Woodward building, Washington, D. C.

RAILWAY CAR MEN'S CLUB OF PEORIA AND PEKIN.—C. L. Roberts, chief clerk, Peoria & Pekin Union Railway, 217 Lydia avenue, Peoria, Ill.

RAILWAY CLUB OF GREENVILLE.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meetings third Tuesday of each month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August, Ft. Pitt Hotel, Pittsburgh, Pa.

RAILWAY FIRE PROTECTION ASSOCIATION.—R. R. Hackett. Baltimore & Ohio, Baltimore, Md.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, July, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

SUPPLY MEN'S ASSOCIATION.—E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division American Railway Association.

TORONTO RAILWAY CLUB.—J. A. Murphy, 1405 Canadian National Express building, Toronto 2, Ont. Meetings third Monday of each month, except June, July and August.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eight street, Cleveland, Ohio.

WESTERN RAILWAY CLUB.—J. H. Nash, 343 South Dearborn street, Chicago. Regular meetings, third Monday in each month.

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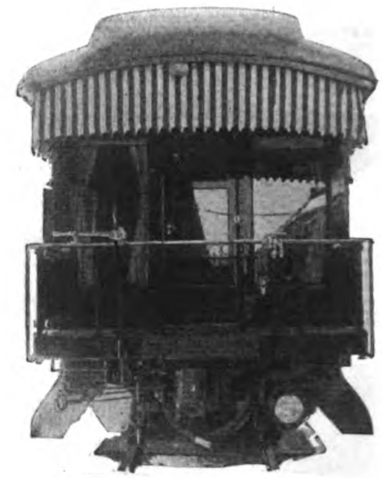
NEWS



THE ST. LOUIS-SAN FRANCISCO has reduced by 5 per cent the salaries of supervisory officers receiving $250 to $350 a month and of some employees receiving less than $250 who are not on a five-day week. This reduction is in addition to the reduction of from 5 to 20 per cent which was put in effect last January.

THE CHICAGO, ROCK ISLAND & PACIFIC, as a part of its project for the conversion of 231 locomotives from coal burning to oil burning, has undertaken the construction of fuel oil stations at 17 points on its lines south and west of Kansas City, Mo. These stations have a total estimated cost of about $90,000 and all work will be done by railway company forces. Each station will consist of a second hand tank-car body buried in the ground near the fueling track, a track trough for unloading oil into the car body, one or more oil cranes and the necessary pumping facilities. At Armourdale, near Kansas City, a 5,000-bbl. tank for the storage of fuel oil will be constructed.

Railway Men on Relief Committee

R. H. AISHTON, president of the American Railway Association, Daniel Willard, president of the Baltimore & Ohio, and Alvanley Johnston, grand chief engineer of the Brotherhood of Locomotive Engineers, have been appointed by President Hoover as members of the advisory committee which is to assist Walter S. Gifford, president of the American Telephone & Telegraph Company, appointed by the President to organize a system of unemployment relief.

Aluminum Pullman Cars Being Developed

THE PULLMAN COMPANY is experimenting with the application of aluminum to sleeping cars and plans to construct an all-aluminum sleeping car within a year. According to present plans, the entire car, with the exception of the wheels, axles and springs, will be made of aluminum, and, as a result, the weight of the car and the cost of moving will be reduced materially, as compared with present conditions and practice. The interior arrangement of the new car will differ from that of the standard Pullman sleeping car.

Purchases and Stores Division Announces Contest

THE PURCHASES AND STORES DIVISION, A. R. A., has announced a contest similar to contests held in previous years for papers on railway purchases and stores work and problems. The contest is open to all employees of railway purchasing and stores departments below the rank of assistant purchasing agent and assistant general storekeeper.

The article submitted must have at least 1,000 words and not more than 3,000, and the same must be in the hands of the secretary not later than March 1, 1932.

Increased Fuel Efficiency

THE RAILROADS in the first six months of 1931 established a new record for efficiency in the use of fuel by locomotives, according to reports filed with the Interstate Commerce Commission. An average of 122 lb. of fuel was required to haul 1,000 tons of freight and equipment, including locomotive and tender, a distance of one mile. This average was the lowest ever attained for any corresponding period, being a reduction of 3 lb. under the best previous record established in the first half of 1930. In the passenger service an average of 14.8 lb. was required to move each passenger train car one mile, compared with 15 lb. in the first half of the preceding year. Class I railroads in the first half of 1931 used for locomotive fuel 42,672,474 tons of coal and 1,012,932,384 gallons of fuel oil.

Pneumatic-Tired Rail Car Developed in France

A PNEUMATIC-TIRED RAIL MOTOR CAR recently developed in France, performed satisfactorily in a series of tests conducted on the Paris-Orleans and the French State railways, under the auspices of the Michelin Tire Company. The car, according to the description in a recent issue of Modern Transport (London), embodies an adaptation of the automobile design with streamline effects. It is equipped with a 46 h.p. engine and weighs approximately four tons.

The wheel on which the newly-developed pneumatic tire is fitted consists of a central hub with a detachable flanged steel rim, similar to the steel tires on railway rolling stock. The tire rests on the flat rim against the inner flange and is held in position by a smaller flange attached to the face of the wheel. The tire is so designed that a puncture is followed by a barely perceptible deflation and thus the danger of derailment from a blowout is minimized. Among the advantages claimed for the vehicle are its smoother riding qualities and its ability to be stopped in a short distance because of the adhesion qualities of rubber and steel. The vehicle is not now designed for interchangeability between rails and highway.

Railway Labor to Ask Shorter Work Periods

LEGISLATION to provide for a shorter work-day and work-week for railway employees, "to reduce unemployment and stabilize employment," is to be sought by the Railway Labor Executives at the next session of Congress, according to a statement they have just issued in further explanation of the matters discussed at a three-day meeting in Washington in July. An executive committee was directed, with the aid of counsel, to prepare a bill to be introduced for that purpose. The plan has been under consideration at meetings of the railway labor organizations for a long time and the labor executives some time ago tried to

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Domestic Orders Reported During August, 1931

Locomotives

Name of Company	Number Ordered	Type	Builder
Lehigh Valley	2	Gas-electric	Electro-Motive Co.
	2	Oil-electric	American Locomotive Co.
	1	Oil-electric	Ingersoll-Rand Co.
Jay Street Connecting Railroad	1	Oil-electric	American Locomotive Co.
Total for month of August	6		

Freight Cars

Name of Company	Number Ordered	Type	Builder
Carnegie Steel Company	30	Hopper	Greenville Steel Car Co.
Litchfield & Madison	4	Caboose	American Car & Fdy. Co.
New York Central	300	Gondola	Company Shops
	200	Gondola	Merchants Despatch Transportation Co.
Total for month of August	534		

Revenue Earners

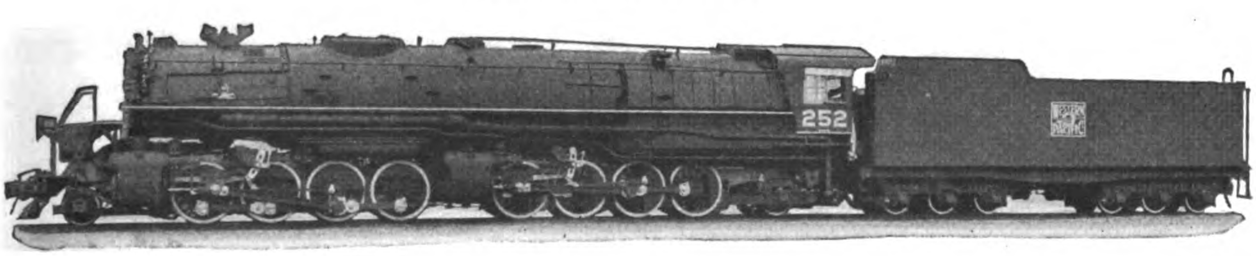
THE economies effected by the use of strictly modern power will pay for such locomotives well within their life-time — frequently in from 5 to 10 years. Only boiler horse-power and big drivers give Speed *and* Tonnage.

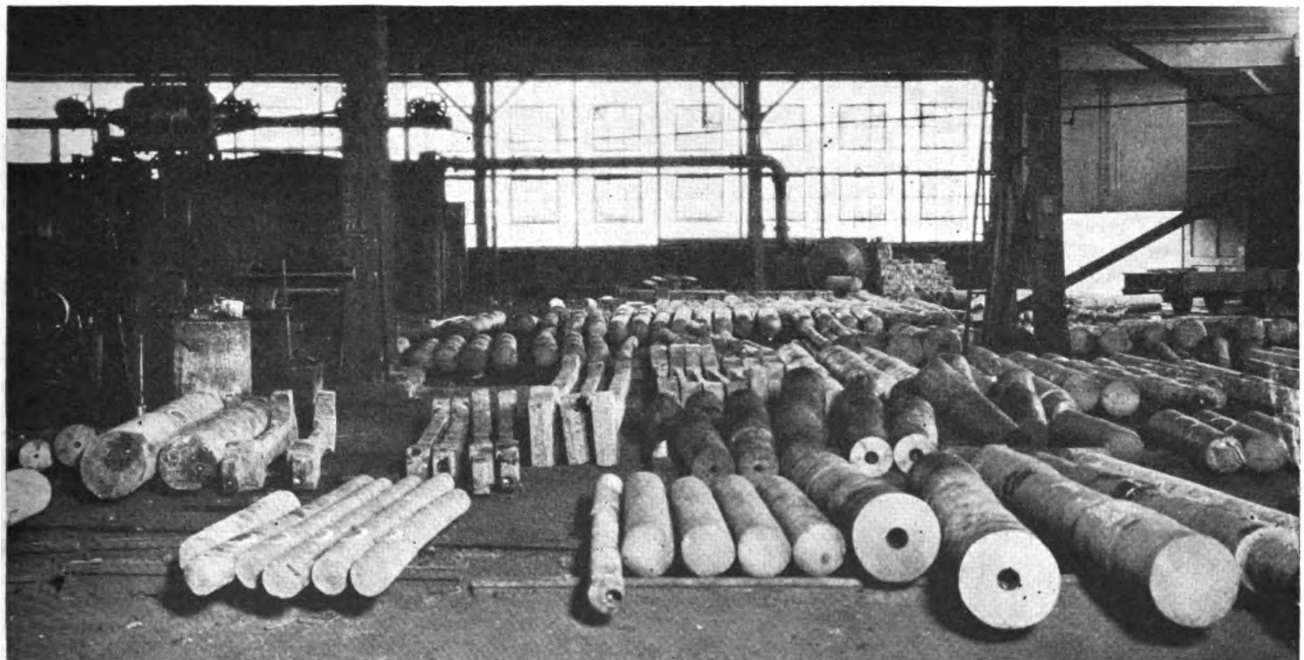
THE BALDWIN LOCOMOTIVE WORKS
1831
1931

It takes Modern Locomotives to make money these days!

THE BALDWIN LOCOMOTIVE WORKS

PHILADELPHIA





bring about a conference with the Association of Railway Executives on the subject by including it in a plan for co-operating with the railway executives on methods for dealing with the competition of other forms of transportation. The executive committee includes D. B. Robertson, of the Brotherhood of Locomotive Firemen and Enginemen, A. Johnston, of the Brotherhood of Locomotive Engineers, A. O. Wharton, of the International Association of Machinists, F. H. Fljosdal, of the Brotherhood of Maintenance of Way Employees, and C. M. Sheplar, of the National Marine Engineers' Beneficial Association.

According to the statement the labor executives also discussed at some length, but deferred action on, the subject of unemployment insurance. They also approved certain principles to govern the draft of a bill to provide for "retirement insurance" by which railroads would be required to provide retirement insurance for superannuated employees, to be paid for through voluntary contributions from employer and employee fixed on a sound actuarial basis, "whereby the individual employee will acquire a vested right in trust funds, which can be maintained and enforced by him or his beneficiary just as other forms of insurance." After stating certain requirements the statement said that there has been no plan proposed and no bill drafted which meets these requirements and that no bill will be endorsed by the association until they have been met.

C. N. R. Employees Take Half-Day Off

FOLLOWING an agreement reached between the management of the Canadian National and representatives of the railway employees, it was announced in Montreal that, effective August 1, officers and employees of the Canadian National receiving less than $4,000 per annum would be off duty one-half day per week without pay, and payroll deduction would be made accordingly. This information is contained in an official letter to heads of departments, signed by Sir Henry Thornton, chairman and president of the railway.

The arrangement covers clerical and other forces who are working under union agreements with the company and non-scheduled employees as well. Officers receiving more than $4,000 per year have taken a salary reduction of ten per cent, announcement to that effect having already been made.

So far as practicable, the president's letter states, the half-day period off duty will take place on Saturday morning. Where the Saturday morning is not feasible, employees will be relieved half of another working day.

The arrangement is designed to obviate the necessity of discharging a large number of employees and thereby adding to unemployment. The reductions in the payroll on account of the half-day lay-off per week will amount to eight and one-third per cent.

Supply Trade Notes

THE OHIO BRASS COMPANY, Mansfield, Ohio, has moved its Cleveland office from the Union Trust building, to 540 Terminal Tower.

THE ARMSPEAR MANUFACTURING COMPANY has moved its headquarters from 447 West Fifty-third street to 250 West Fifty-fourth street, New York.

T. R. LANGAN has been appointed north-eastern district manager of the Westinghouse Electric & Manufacturing Company, with headquarters at New York City.

L. S. HAMAKER, advertising manager of the Republic Steel Corporation, has been appointed manager of sales promotion, with headquarters at Youngstown, Ohio.

R. E. WALKER, representative of the American Rolling Mill Company, with headquarters at Middetown, Ohio, has been placed in charge of the office at Tulsa, Okla.

THE INGOT IRON RAILWAY PRODUCTS COMPANY, Middletown, Ohio, has opened a branch office at 509 Forsyth building, Atlanta, Ga. E. T. Cross has been placed in charge.

THE READING IRON COMPANY, Reading, Pa., has consolidated its general executive and general sales offices in Philadelphia, Pa., on the tenth floor of the Terminal Commerce building, 401 North Broad street.

THE JOYCE-CRIDLAND COMPANY, Dayton, Ohio, manufacturers of Joyce jacks and Joyce auto lifts, has moved its New York office from 105 West Fortieth street to 143 Liberty street. Arthur S. Beattys, eastern sales manager, is in charge.

JOHN S. BLEECKER, formerly consulting engineer specializing in transportation and merchandising, has been appointed manager of sales of Lukenweld, Inc., division of Lukens Steel Company, Coatesville, Pa.

THE PRESSED STEEL CAR COMPANY, Pittsburgh, Pa., has awarded a contract to the Austin Company for the reconstruction of six buildings, at its Chicago plant, recently destroyed by fire. The cost of repairing the buildings will approximate $60,000.

THE A. M. BYERS COMPANY, Pittsburgh, Pa., has taken a six-months option to purchase the Canonsburg Steel & Iron Works, Canonsburg, Pa. The latter company which is controlled by the Edwards Manufacturing Company, Cincinnati, Ohio, was founded in 1902 and has an annual capacity of 38,000 tons of black sheets and 16,000 tons of galvanized sheets.

WALTER A. DEEMS, for several years in the machine tool department of Manning, Maxwell & Moore, Inc., has opened an office under the name of Walter A. Deems & Co., at 143 Liberty street, New York, as manufacturers agent. He now represents the Edna Brass Manufacturing Company, Cincinnati, Ohio; the L. J. Bordo Company, Inc., Glenside, Pa., and the B. F. Nelson Manufacturing Company, Minneapolis, Minn. Mr. Deems, previous to his service with Manning, Maxwell & Moore, Inc., served as master mechanic on the New York Central and later as master mechanic on several divisions of the Baltimore & Ohio.

HALE HOLDEN, JR., assistant to the president of the Pullman Company, has been elected vice-president of the Pullman Company. Mr. Holden entered the employ of the Pullman Company on September 15, 1922, as a draftsman at the Pullman Car Works, Pullman, Ill., and on January 1, 1923, was transferred to car building and worked in various capacities in both the passenger and freight shops. Later he became an inspector in the mechanical department and then a clerk in the office of the vice-president and general manager. On January 1, 1924, he was placed in the sales department, but returned to the operating department six months later as assistant district superintendent of the central zone, and later in the Chicago Eastern-Southern and Central districts. On February 1, 1925, he returned to sales work with the Pullman Car & Manufacturing Corporation, and five years later became assistant to the president of the Pullman Company.

H. Holden, Jr.

THE ROBERT W. HUNT COMPANY, Chicago, has installed an X-ray laboratory service for the inspection and testing of metallic materials. These facilities are designed to X-ray steel objects up to 3½ in. in thickness and aluminum objects up to 8 in. in thickness, while there is no limit to the size of the specimens that may be tested provided they can be loaded on a freight car.

THE WORTHINGTON PUMP & MACHINERY CORPORATION, New York, has acquired the manufacturing and marketing facilities of Metalweld, Inc., Philadelphia, Pa.,

(Continued on next left-hand page)

builders of portable compressor units. For many years Worthington has been engaged in the compressor industry, and last year took over the manufacture and sale of Gilman rock drills and accessories. Worthington is now in a position to supply the air equipment requirements of railroads and industrial users. The portable compressors will be manufactured at the Harrison, N. J., works of the Worthington Pump & Machinery Corporation, and the engineering, manufacturing and sales personnel of the Metalweld organization also will be located there.

CHARLES P. WHITEHEAD, who has been promoted to the position of manager of sales of the General Steel Castings Corporation, with headquarters at Eddystone, Pa., was graduated from the Culver Military Academy, Culver, Ind., in 1917, and served during the World War in the Naval Reserve Flying Corps, until 1919. After a few months with the Missouri-Kansas-Texas, he entered the employ of the Commonwealth Steel Company on July 1, 1919, and spent several years in the engineering department and also in the different departments of the plant. He joined the Commonwealth Steel Company's sales department in 1922 and since that time has served the railroads located in the western part of the country. On April 1, 1930, Mr. Whitehead was appointed sales assistant to the vice-president and general manager of the Commonwealth division, Granite City, Ill.

Charles P. Whitehead

HARRY R. BARTELL, who has been promoted to the position of manager of the western district sales, of the General Steel Castings Corporation, with headquarters at Granite City, Ill., began his business career in the mechanical engineer's office of the New York Central lines at Cleveland, Ohio, in 1909 and, in 1913, he was transferred to the Collinwood shops' office. He resigned this position in 1915 to accept an appointment as car designer for the Atlas Car & Manufacturing Co., Cleveland, Ohio, and came to the Commonwealth Steel Company in 1916 as chief estimator at the plant in Granite City, Ill. In 1917, he was transferred to the general office as assistant to the chief mechanical engineer, was appointed assistant mechanical engineer in 1920, and mechanical engineer in 1922. Since 1924, he has been a sales engineer, continuing in the same position since the Commonwealth Steel Company was merged with the General Steel Castings Corporation.

Harry R. Bartell

WILLIAM M. SHEEHAN, who has been appointed manager of the eastern district sales, of the General Steel Castings Corporation, with headquarters at Eddystone, Pa., received his academic education at St. Andrews school, Roanoke, Va., and later took university extension work and a special course at St. Louis University. He served an apprenticeship as machinist in the Roanoke shops of the Norfolk & Western and in the drawing room of the mechanical engineer's office. He later held positions in the engineering departments of the General Electric Company, the New York Air Brake Company, and the Keith Car & Manufacturing Co., and, in December, 1913, entered the employ of the Commonwealth Steel Company. He became assistant mechanical engineer on July 1, 1915, and since January 1, 1919, held the position of sales engineer with the Commonwealth and its successor, the General Steel Castings Corporation. On April 1, 1930, he was appointed sales assistant to the vice-president and general manager of the Eastern division at Eddystone, Pa.

William M. Sheehan

R. S. FOLK has resigned as sales representative of the Auxiliary Locomotive Division of the Bethlehem Steel Company at New York to become railroad representative of the York Ice Machinery Corporation at York, Pa. Mr. Folk, who will handle the sale of air-conditioning equipment for passenger-train service, was born in 1887 at Baltimore, Md. He was educated in a private school and in 1906 graduated from the Baltimore Polytechnic Institute. He then worked for two years in the shop of the Baltimore Bridge Company where he completed a course covering all departments in bridge construction. For the next two years he was a draftsman in the engineering department of the Baltimore Bridge Company. He then entered the bridge department of the American Bridge Company at Pittsburgh, Pa., as a designer on bridge and erecting work. Resigning six years later, he was appointed structural sales engineer of the Bethlehem Steel Company at Chicago. He remained in the latter position for three years and for the next two years was sales agent of the General Fireproofing Company at Cleveland, Ohio. He then returned to the Bethlehem Steel Company and for six years was in charge of the structural fabricating department. When the Bethlehem Steel Company took over from the Delaware & Hudson the manufacture and sale of the auxiliary locomotive, Mr. Folk was placed in charge of the sale of this product to all of the eastern railroads. After serving for five years in this capacity, he now becomes railroad representative of the York Ice Machinery Corporation.

R. S. Folk

AN ARRANGEMENT has been made between the Carrier Engineering Corporation, Newark, N. J., the Safety Car Heating & Lighting Company, and the Vapor Car Heating Company, Inc., for the sale and servicing of air-conditioning equipment to the railroads. The Safety Car Heating & Lighting Company will function as the sales distributor of the Carrier air-conditioning and cooling system and will continue to handle lighting and heating equipment. It will also handle the servicing of the air-conditioning and cooling systems. The Vapor Car Heating Company, Inc.,

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Railway Mechanical Engineer

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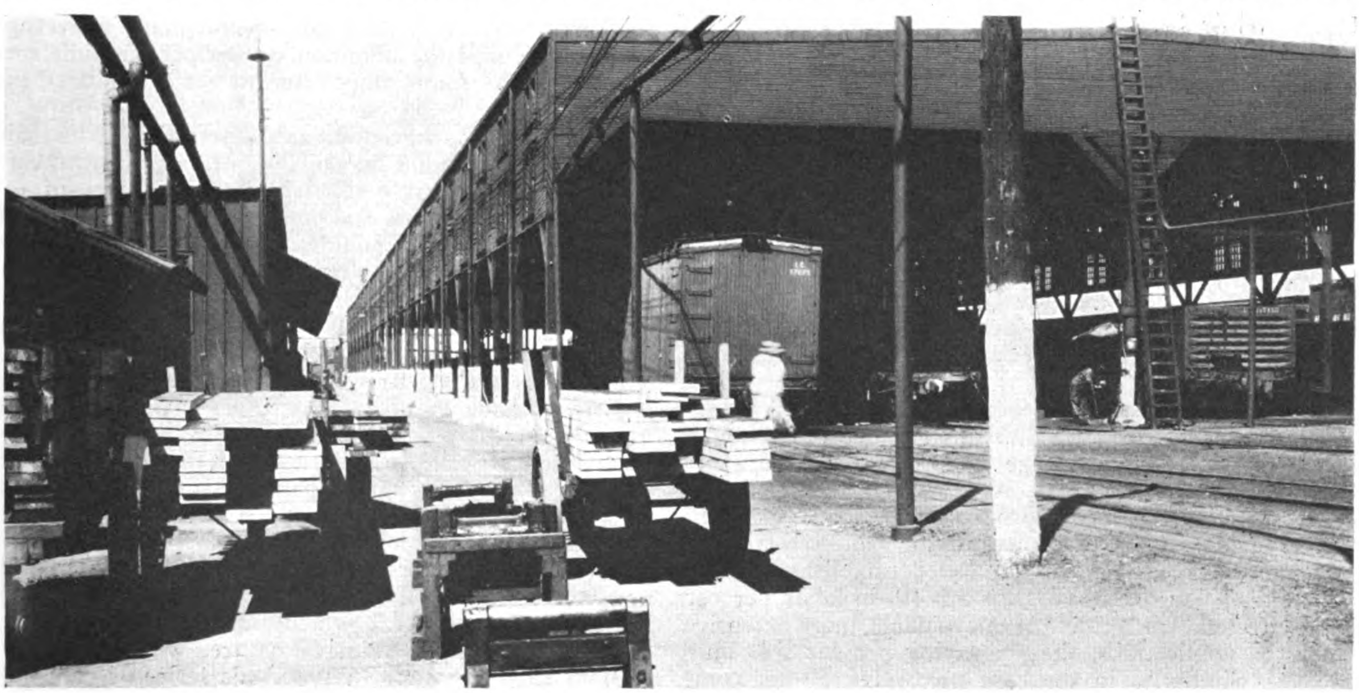
Illinois Central Develops Unit Car Cost System

Resultant accurate knowledge of detailed repair costs promotes economy in freight car maintenance

THREE methods of controlling freight-car maintenance work in the interests of efficiency and economy have been developed on the Illinois Central and are generally followed throughout the system; namely, a production or time-checking system, which provides for the expeditious handling of emergency or running-repair work; a progressive or spot system, which assures the orderly handling of material and cuts out lost motion in making classified repairs; and a unit cost recording system, which affords an accurate knowledge of the labor, material and overhead costs of giving classified repairs to individual freight cars.

The production checking system, similar to that used on the Missouri Pacific, the Union Pacific and possibly other roads, was installed in November, 1929. The progressive system has been generally in effect since about the same time and the unit cost system since early in 1930. The urgent desirability of a unit car cost system has long been recognized by forward-looking car men, but the Illinois Central is one of the first roads, if not the first, to develop a practical method of arriving at individual freight-car repair costs without paying an ex-



Illinois Central freight-car shops, Centralia, Ill.

cessive penalty in the way of increased supervision and clerical expense. By the Illinois Central method, most of the notations regarding detailed operations and time consumed are made by the shop forces themselves and one additional clerk per 100 men employed on classified repairs is required. For this relatively small expense, the objective is achieved of substituting knowledge for guess work as to what materials, shop methods, machinery and men are producing the best results.

The advantages of the unit car-cost system, here briefly summarized, can hardly be overestimated. System shops are enabled to measure their records against past performances and against each other. Lost time is saved by indicating over-manned groups or gangs. An incentive is provided to save both labor and material in mill rooms, wheel shops and other production departments, as well as in car-repair gangs. For example, a gang foreman can no longer tolerate unproductive labor, or use 10-ft. siding when 8-ft. material would do, without the additional expense showing up on the car cost sheets. The stock book, hitherto considered inviolable, is sometimes shown to need revision.

Comparative Statement of Average Labor Cost per Hour, also Painting Material Used on 50-Ton Composite Gondola*

Shop	Stripping	Body	Trucks	Brakes	Painting	Total labor	Painting material
A	.916	.815	.692	.935	.78	.816	9 81
B	.67	.67	.67	.73	.64	.669	6.81
C	.64	.796	.844	.746	.596	.744	11.10
D	..	.81	.83	.832	.534	.776	7.21

* This typical statement illustrates how the unit cost system shows up shops in which various groups of work cost more than appears necessary.

Classification of Freight Car Repairs Used on the Illinois Central

CLASS 1—HEAVY REPAIRS

Cars given general or thorough overhauling, including painting, or when the repairs cost in excess of the amount shown for each group.

(a) Refrigerator cars	$500
(b) Other house type cars	$350
(c) Gondola and hopper cars	$250
(d) Flat cars	$200

CLASS 2—MEDIUM REPAIRS

Cars given repairs of a less extensive nature than described under Class 1 repairs, when more than 20 man-hours (directly applied labor) is consumed. This class of repairs to receive repainting. The repairs in each group costing between figures shown:

(a) Refrigerator cars	$101 to $500
(b) Other house cars	$101 to $350
(c) Gondolas and hoppers	$101 to $250
(d) Flat cars	$101 to $200

CLASS 3—LIGHT REPAIRS

Necessary repairs to trucks, air brakes, draft gears, and light repairs to superstructure and repainting. The man-hours not to exceed 20, and cost not to exceed $100.

There may be instances where cost of repairs may exceed $100, but man-hours will be less than 20, such as when trucks are renewed, etc., but in such cases the man-hours will govern and car be classified as light repairs.

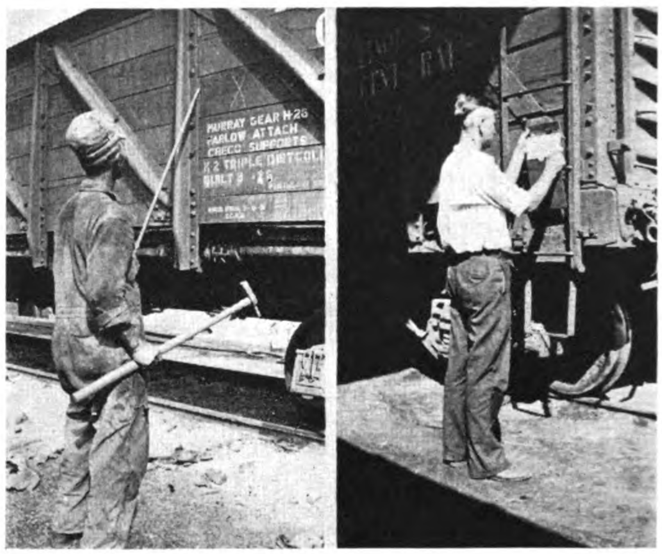
The local supervision is given the information it needs to balance budgets, and the general office has adequate data available to set up, intelligently, system policies and programs, and answer all questions of management.

Measurable results of the unit cost system in actually reducing costs are illustrated in one of the small tables showing the average cost of giving the same class of repairs to twelve 50-ton all-steel hopper cars early in 1930 under the progressive system only, and later, in May, 1930, to 12 cars of the same series when the unit cost system was quite well established. A reduction of 38.5 man-hours, or $31.10, in labor per car was effected. On account of unavoidable, more extensive material applications, the net saving per car was only $5.64. Similarly, in the case of twelve 50-ton composite gondolas the labor saving was 23.5 man-hours, or $16.71 per car. In this case, the increased material cost was just enough to slightly over-balance the labor saving. The way in which detailed labor and painting material costs, for example, are checked in one system shop against another is well illustrated in another table.

How the Unit Cost System Originated

Immediately following the appointment of G. C. Christy as superintendent of the car department of the Illinois Central in November, 1929, a complete survey of the system freight-car equipment was ordered. This survey, conducted by series and types of cars, developed comprehensive data as to the physical condition of cars in the respective series but, other than rough estimates, no figures were available as to the expense that might be involved in rehabilitating a given group or series.

Foremen at various shops gave figures representing a wide variance in the cost of identical operations. To meet the need of some adequate method of recording



Inspector marking out defective siding with extension yellow crayon (left)—Checker referring to original records in metal container (right)

the cost of repairing each car, several plans were suggested, but until the adoption of the present unit cost system, it was found impossible to get the desired information.

To provide a background for a description of the unit cost system, it should be said that Illinois Central car-maintenance work is divided into three classes of repairs—heavy, medium and light—as shown in one of the tables. For geographic and traffic reasons, classified repairs are segregated by types of equipment, principally at three system shop points, as follows: Steel and composite coal cars at Centralia, Ill.; house and flat cars at Nonconnah (Memphis), Tenn.; refrigerator, wooden box and stock cars at McComb, Miss. The endeavor is made to give freight cars classified repairs in cycles of three years, approximately. For example, a hypothetical series of box cars built in 1927 will come due for Class 3, or light repairs, during 1930. When these cars are shopped, they will receive necessary repairs to trucks, air brakes, draft gear, superstructure and repainting, the cost of which it is estimated will not exceed $100. In 1933, these cars will be shopped for Class 2 repairs, at which time they will receive repairs of a more extensive nature, which will cost $101 to $350 per car. In 1936, this series of cars will be due for Class 1, or heavy repairs, at that time receiv-

ing a thorough overhauling, at a cost probably in excess of $350 per car.

As cars are selected and assigned to a shop for classified repairs by series and pass over the stripping track, the foreman in charge hangs a metal container on the side or end of each car with the original-record-of-repairs form inserted, this container moving with the car until all repair work is completed. On the mimeograph forms listing labor and the individual parts of the car, the proper information is recorded as the car progresses through the shop, it being the duty of the foreman in charge of each section to see that proper information as to the material applied and the labor-hours expended is inserted for that particular "spot."

Average Cost of Giving Class I Repairs to Twelve 50-Ton All-Steel Hopper Cars

	Under progressive system	Assisted by unit cost system
Average man-hours per car	210.5 hrs.	172 hrs.
Average cost of labor per car	$159.83	$128.73
Average cost of materials per car	521.76	547.22*
Average cost of labor and material per car....	681.59	675.95

*Increased material application unavoidable owing to the condition of the second group of 12 cars.

After the car has gone through the shop and has reached the final inspection point prior to release for service, the original record forms are removed and sent to the office for a complete compilation of the cost involved.

The practical working out of this system can best be grasped by reference to the actual record of maintenance work on a 50-ton composite hopper car No. 218566 taken in the shop on September 2.

Car 218566 was placed on the stripping track and work started at 7:00 a. m., September 2. Stripping was completed at 8:00 a. m. The car was then switched to the shop track. It arrived at body position No. 1 for steel work at 8:15 a. m. The draft gear and couplers were removed and steel work completed at 10:15 a. m. The car then moved to position No. 3 where the dump doors were removed and the underframe cleaned. This work was completed at 11:15 a. m. The car then moved to position No. 4 and Continental car cement was applied to the underframe, completed at 1:30 p. m. The car moved to position No. 5 and floor boards were applied, completed at 2:45 p. m. The car then moved to truck position No. 6 where the trucks were removed, repaired and replaced, completed at 4:00 p. m., September 2. The car then moved to position No. 7 where the dump doors were repaired and re-applied, completed at 8:15 a. m. on September 3. The car then moved to position No. 8 where side planks were applied and bolted, completed at 9:30 a. m. The car then moved to position No. 9 where couplers and draft gear were applied, completed at 10:30 a. m. The car then moved to position No. 10 for safety-appliance and air-brake work and test, completed at 11:45 a. m. The car was mechanically O. K. at 11:45 a. m. on September 3, then being moved to the paint track and given one coat of paint. A second coat of paint was applied on September 4. The car was stencilled, reweighed and released for service on September 5. The painting time is shown in total as this is spread over several hours, due to drying time required.

Elwell-Parker gasoline-electric crane truck used to move cars as well as for all kinds of material-handling jobs

How the Cost Records Are Kept

To bring about uniformity at the classified repair points, the work of installing the unit car-cost system was handled by the same traveling mechanical inspector who, in conjunction with his regular work, follows the

Form CD-12 - Record of Labor on 50-Ton Composite Gondola Car No. 218566

Position	Time On	Time Off	80	78	75	73	63	61	59	57	55	46	39	36.5	Total	Total including shop expense
			Hourly rates of pay (cents)													
Stripping	7:00 a.m.	8:00 a.m.		.50		6					.75				7.25	
Cost				$.39		$4.38					$.41				$5.18	
Total cost for stripping with shop expense added															6	$6.73
Body No. 1	8:15 a.m.	10:15 a.m.				2					4	2				
No. 2	Vacant on	this type of car														
No. 3	10:15 a.m.	11:15 a.m.		1		5	1				7			1		
No. 4	11:15 a.m.	1:30 p.m.									2.50			1.25		
No. 5	1:30 p.m.	2:45 p.m.				5					2.50					
No. 7	4:00 p.m.	8:15 a.m.				8.75			1.25	1.25	2.50					
No. 8	8:15 a.m.	9:30 a.m.				3.75					1.25					
No. 9	9:30 a.m.	10:30 a.m.				2										
No. 10	10:30 a.m.	11:45 a.m.				2.50							1.25			
Total hours				1		29.00	1		1.25	1.25	19.75	2	1.25	2.25	58.75	
Cost				$.78		$21.17	$.63		$.74	$.71	$10.86	$.93	$.49	$.82	$37.13	
Total cost of body work with shop expenses added																$48.27
Trucks 6	2:45 p.m.	4:00 p.m.		.75		3.75					3.25				7.75	
Cost				$.59		$2.74					$1.79				$5.12	
Total cost of truck work with shop expense added																$6.66
Air brakes						1										
Air brakes						1.50										
Total hours						2.50									2.50	
Cost						$1.83									$1.83	
Total cost of air brake work with shop expense added																$2.58
Cleaning											5					
Painting & stenciling	9/3	9/5				3					1.75					
Total hours						3					6.75				9.75	
Cost						$2.19					$3.71				$5.90	
Total cost of painting with shop expense added																$7.67

Work started	Sept. 2	Total number of man-hours consumed	86
Mechanical work completed	Sept. 3	Total cost for lator	$55.16
Painting completed	Sept. 4	Total cost with shop expense added	$71.71
Restenciled and reweighed	Sept. 5		

system with periodical check-ups to insure uniform handling of cost records.

In 1930, when the cost system was first installed, the average classified repair shop on the system, employing approximately three hundred men, retained a cleri-

Form CD-46 - Showing Cost and Hours To Repair Freight Cars

Date September 5, 1931

Shop Centralia, Ill.

Car number	Date completed	Items	Stripping	Body	Truck	Air brake	Paint	Total	Class of repairs
		No. hrs.	7½	58¾	7¾	2½	9¾	86	
		Labor	6.73	48.27	6.66	2.38	7.67	71.71	
		Material	0	63.26	7.13	1.20	8.29	79.88	
218566	9/5/31	Total	6.73	111.53	13.79	3.58	15.96	151.59	2

cal force of six men, comprising a chief clerk, a bad-order clerk, two record writers, an A. R. A. clerk and a steno-clerk. With the addition of three clerks to these forces for checking time and figuring the value of materials used, there was no difficulty in keeping the

Form CD-10 - Typical Mimeographed Form for Body Work Material on Car No. 400065

Check of Material R&R or Renewed — Date of Repairs

No. of pieces	Body Work — Check of material	Dimensions of material	Cost of material
1	Badge plate	M5192	$ .47
2	Badge plate rivet		.01
2	Coupler tie straps reformed		.26
8	Coupler tie straps rivets	7/8 in. by 2½ in.	.19
6	Side plank, 2¼ in. by 9¾ in.	5 ft. 2 in. long	3.24
2	Side plank, 2¼ in. by 9¾ in.	10 ft. 4 in. long	3.21
6	Side plank bolts	5/8 in. by 3¼ in.	.18
39	Side plank bolts	5/8 in. by 3¼ in.	1.23
2	Type D coupler bodies - reclaimed		2.64
2	New Miner draft gear	A-22XB	52.19
2	New Miner follower plates	F1830	4.60
2	Farlow draft gear blocks - reclaimed		.96
2	Coupler shims, 1/4 in. thick	4 in. by 10½ in.	.18
2	Release lever bolts	5/8 in. by 7½ in.	.08
2	Release lever bolts cotter keys		--
	Total net material charge		$70.26
	Plus store expense		75.18

records. In other words, only one additional clerk per 100 car men employed on classified repairs was required.

Clerks in charge of the compilation of the cost records are supplied with material price lists, revised and

Motor cycle with side car for the rapid delivery of light material

kept up to date by co-operation with the stores department. These lists are alphabetically indexed to facilitate application of the proper storehouse price. The scrap credits for material removed are deducted from the storehouse prices, leaving only one extension to be made in order to arrive at the net cost of material charged to the car. Prices for lumber are worked out in the mill room to cover finished sizes, and the cost of fabrication is added. A similar practice is followed in the case of forged metal parts, wheels, axles and all materials supplied on shop orders.

The record of labor is kept on Form CD-12, illustrated. A timekeeper inserts the number of hours on each "job" directly beneath the rate per hour applying to the class of work involved. In making the extensions, the clerk can in this way readily determine the total number of hours and money spent for labor.

In the compilation of information for transmission

(Concluded on page 490)

J-3-30-20M F. C. 3-30 — Form G.S.M.P. 221

Illinois Central System — **Record of Cost of Repairs Freight Cars** — CAR No. 402034

SHOP	Date Repaired		Stripping	Body Work	Truck Work	Air Brake Work	Painting	TOTALS	Class of Repairs
Nonconnah	6/4/31	No. Hours	2	15	4	1	6½	28½	Medium
		Labor	1.28	11.88	3.18	.85	3.73	20.92	
		Material	.11	76.41	5.24	6.00	11.10	98.86	
		Total	1.39	88.29	8.42	6.85	14.83	119.78	

J-3-30-20M F. C. 3-30 — Form G.S.M.P. 221

Illinois Central System — **Record of Cost of Repairs Freight Cars** — CAR No. 53001

SHOP	Date Repaired		Stripping	Body Work	Truck Work	Air Brake Work	Painting	TOTALS	Class of Repairs
McComb	1/30/31	No. Hours	–	19	1	2½	3½	26	Light
		Labor	–	13.61	.82	1.99	2.27	18.69	
		Material	–	6.47	1.72	2.12	7.55	17.86	
		Total	–	20.08	2.54	4.11	9.82	36.55	
		No. Hours							
		Labor							
		Material							
		Total							

Typical cost record cards for individual cars—Filed at the general office

New Materials Will Cut Locomotive Repair Costs*

***By C. E. Barba*†**

Studies suggest that, instead of designing to take up wear, there is a wide range of possibilities for designing to eliminate it

About the last word in the steel world are the special steels that have been produced to be used in applying the super-hard cases that are built up by heating the finished parts in ammonia gas. These are known as nitrided steels.

The ammonia gas dissociates into nascent nitrogen and hydrogen at about 850 deg. F. The parts to be hardened on the surface are first formed, then heat treated, and then finished machined, ground and polished before placing in the retort for nitriding. The nascent nitrogen at 925-975 deg. F. combines with the iron, chromium and molybdenum in the steel to form nitrides of these elements, and these nitrides form the hardest wearing surface that science has been able to develop, excluding the carbide cutting tools. It has been known as early as 1907 that nitrogen would, under certain conditions, combine with iron to form iron nitrides and that these nitride grains were exceedingly hard. But the hard cases formed were very brittle and spalled off from the base metal very easily.

Various investigators worked to bring out steels that would form tougher cases with nitrogen. The final result has been a steel containing chromium, molybdenum and aluminum. The chromium and molybdenum toughen the case and the aluminum acts as a catalyzer and stabilizer to maintain the high surface hardness. The steel is produced in four carbon ranges, running as low as .12 per cent to as high as .65 per cent.

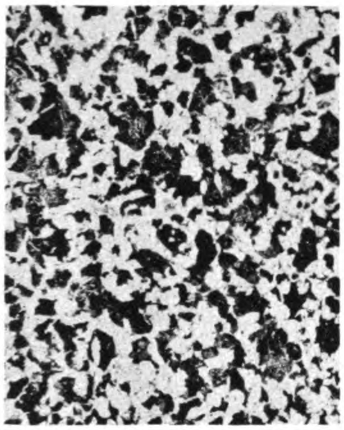
The heat treating and machining are all completed before the hardening operation and that is conducted at low temperature—950-1,075 deg. F.—so that distortion and subsequent grinding are eliminated and parts may be machined to very accurate dimensions or fit and then hardened with little danger of warping.

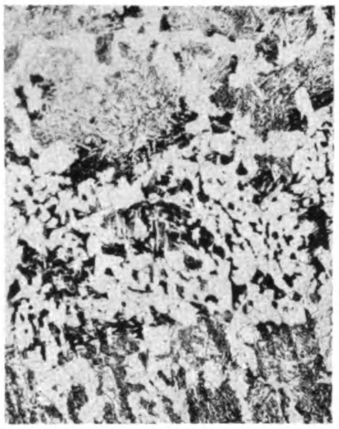
This case is the hardest and most uniform structure ever produced on steel and, as such, its great wear resistance is opening up vistas of long-lived parts for locomotives that were undreamed of before its advent.

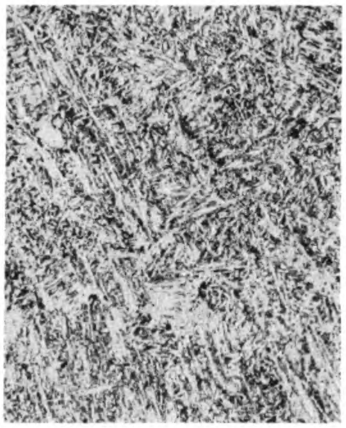
The basic idea in the application of nitrided steels to locomotives is to select for its application those parts in

* Part of a paper presented at the spring meeting of the American Society of Mechanical Engineers, held at Birmingham, Ala., April 20 to 23, 1931.

† Mr. Barba is mechanical engineer of the Boston & Maine.

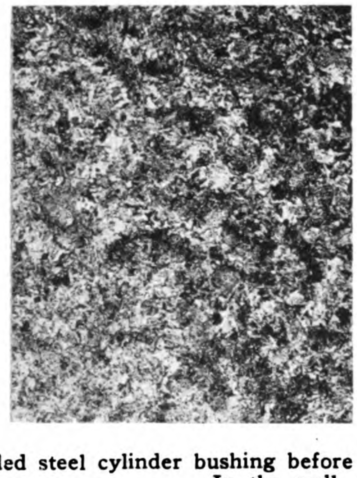


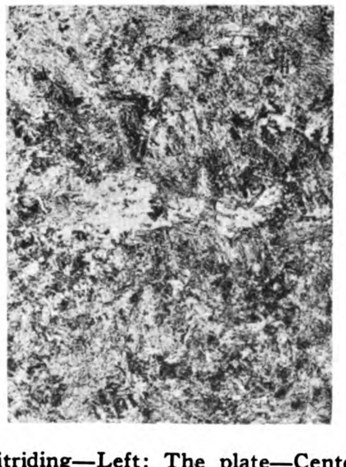


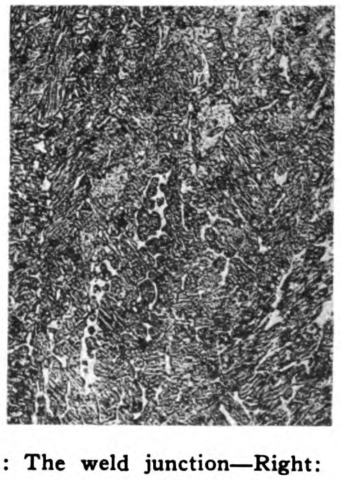


Condition as welded (left)

After heat-treatment (right)







Microstructure of welded steel cylinder bushing before nitriding—Left: The plate—Center: The weld junction—Right: In the well—100x (slightly reduced)

which frictional wear causes heavy expense for renewals. The fundamental law in bearing metals is that if the two parts are of equal hardness they will both wear. If one is hard and the other soft, the softer will take the greater wear. In applying nitrided steel we endeavor to replace those parts which are most expensive to replace and to throw the wear over onto the least expensive part. Where a rotating shaft or pin is to be considered, it is generally cheaper to make the bushing take the wear.

The metallurgists have some long and beautiful stories about the microstructures and the effects of time, temperature and gas pressure in retorts, on the hardness, depth of case, toughness, etc., but the mechanical engineer is interested in two things only; namely, (1) Can wear be reduced without sacrificing strength? (2) Will the increased life of the wearing surface compensate for the higher cost of the material used?

In preparing a wearing surface of nitrided steel we must remember that we are dealing with a surface hard enough to cut glass. Nitrided wearing surfaces must be lapped in, or polished, or glazed, before the nitriding treatment is applied. They are too hard to do much with after nitriding and, furthermore, the best wearing material is on the surface and grinding after nitriding is considered detrimental and poor practice. The selection of bearing metals to be used against nitrided surfaces is of vital importance. New and harder bearing metals are being used with great success. Any application of nitrided steel should also be considered from the standpoint of the bearing metal to work with it, and the men who are building up test data and experience should be consulted.

Theoretically, all moving parts should be on a par with each other as to wear-resisting qualities, so that the weakest link, all other things being equal, in the maintenance and replacement of parts becomes the locomotive tires. The service life of wearing details, by the judicious selection of materials and improvement of design to best utilize these materials, then becomes a multiple of rather than a fractional part of the tire service life.

In order to illustrate just what can be accomplished, it might be well to start at the power end of the locomotive; namely, the cylinders, and analyze present conditions.

All locomotive cylinders are bushed with cast-iron bushings as a means of preserving the cylinder and saddle throughout the life of the locomotive. Cast-iron cylinder bushings of refined iron are undoubtedly the best practice developed through the years, but because of the unsupported piston, the bushings will wear out of round and in time must be rebored. The same thing holds true of the piston, or the bull ring, which suffers a similar wear, and must be built up or replaced with a new one.

This, however, requires dismantling of the cylinder heads, piston, etc., and the tying-up of a locomotive, and it would seem rational to assume that, if the present bushings were replaced with nitrided steel bushings, having a hardness equal to 850-950 Brinell, lapped to a very high polish, the hardness would never be disturbed, as the range of temperature is well within that used for nitriding purposes. The same holds true for piston-valve bushings. Such an installation would undoubtedly mean the elimination of future rebores and the prevention of leaks past the snap rings, thereby conserving steam.

The development of Nitralloy cylinder bushings, other than forgings, presents a most interesting problem in that plate can be used by rolling into shape and welding by the atomic hydrogen arc process, after which it may be machined to size, the bore lapped and nitrided prior to application. The steps are as follows: (1) Welding of 1¼-in. plate rolled into shape; (2) heat-treatment of welded assembly; (3) machining and nitriding of welded assembly.

This work was undertaken with the objective of forming large cylinder bushings for locomotives. After two or three trials the proper technique was developed and several welds free from blow holes were made. Chemical analyses were as follows:

	C	Cr	Al
Welding wire	.256	1.42	1.13
Plates	.26	1.21	.95
Weld No. 1	.122	1.32	.86
Weld No. 2	.178	1.30	.86
Weld No. 3	.139	1.35	.82

The three welds shown average about 10 points less carbon and 27 points less aluminum than the original analysis of the welding rod. The plates had about the same carbon content as the rod. The aluminum remaining in the welds is well above the .60 per cent minimum required to produce a proper case. The drop in carbon is really beneficial as the weld is more ductile than if the carbon had all been retained.

A section about 6 in. long with the weld running its full length was heat-treated, 1,700 deg. F., water, 1,325 deg. F., air; machined from 1¼-in. down to ¾ in., ground on both flat surfaces, and then nitrided for 42 hours at 925 deg. F.

Hardness readings show around 850 to 900 Vickers Brinell. No difference was apparent between the readings on the welds and those made on the parent stock. Micro-section through the case showed the same penetration on the weld as on the parent stock.

The atomic hydrogen process can be successfully used to obtain welds of special steel analysis that will produce a nitrided case idential in hardness and microstructure with the parent metal.

Dendritic structures are retained in the welds that might be broken up by forging, but they are not thought to be detrimental where the bushings are under no particular stress and are only applied to obtain a surface for resistance to wear of the piston and rings.

The success of the operation is entirely dependent on the skill of the welder and a policy of rapid fusion and application of small drops of molten metal at a time must be observed. Puddling the metal will invariably cause excessive loss of aluminum and will develop blow holes in the welds.

The utilization of special steels and the engineering problems in connection therewith are outlined for various locomotive details as a means of stimulating the art.

Piston Heads and Rods

The piston head, irrespective of design, can be made of a special steel forging or casting and the rim nitrided after the grooves have been machined and lapped to dimensions, so as to eliminate groove wear from snap-ring action. This likewise applies to piston-valve parts.

Snap rings can be made of a bronze alloy, L-shaped, capable of sustaining temperatures around 900-950 deg. F. without removing the snap, which, in contact with a highly polished surface of extra hardness, is bound to give maximum life of the piston head and rings.

The possibilities of the use of an extended piston rod should be given further consideration, as the conventional design now in use cannot be defended as one in which the best engineering principles have been incorporated.

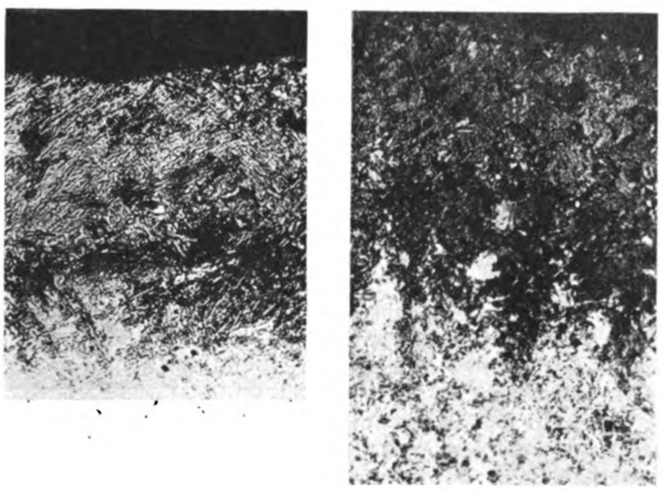
The weight of the piston should be supported at the rear by the crosshead and at the front by a pivoted bearing for alinement which undoubtedly would minimize, or practically eliminate, the wear of piston-rod packing and the circumferential wear of the piston head and simplify the work of the snap rings, since we are starting out with a true bore lapped for accuracy and hardened. The only compression variable of the rings would be that created by the vertical and lateral wear of the crosshead.

The extended piston rod is not a new idea, but its abandonment from general use was largely due to the inability of controlling the wear between crossheads and guides, both vertical and horizontal, within limitations which would not affect the bearing surface of the extended-piston-rod crosshead at the front end of the cylinder.

The adoption of nitrided steel for piston rods, the wearing surface of which can be hardened so as to eliminate wear, should prolong the life of the piston-rod packing, as it is certainly less expensive to replace rings than it would be to grind down piston rods.

Crosshead Shoes and Guides

In the case of crosshead shoes and guides it is considered best to apply nitrided plates to the guides and to apply bearing metal to the crossheads or crosshead shoes in the form of channels which can be quickly removed and replaced at very low cost. The present practice calls for removal of worn guides and building them up with welding bronze. Then they go to the blacksmith shop to be annealed and straightened, then to the planer, the surface grinder, and finally back to the engine where they must be reset. Generally the bolt holes all have to be reamed again and new bolts fitted, so that rehabilitating a worn crosshead guide becomes an expensive job.



Microstructure of the nitrided case—Left: On the weld metal—Right: On the plate surface

The proper selection of steel for controlling the wear of crosshead shoes and guides, or designing either on the basis of increasing the bearing area, thus reducing the pressure in pounds per square inch to a minimum and thereby increasing its life, should assist in re-establishing a design of paramount importance in the reduction of maintenance.

As a matter of fact, there is no reason why guides and crossheads should not be capable of operating 150,000 miles without the necessity of a take-up. The wear of guides is partially due to having a piston hanging at the end of a rod, one end of which is fastened to the crosshead, very much out of balance and ready to drop in its movement equal to the difference in diameter between the piston head and the bore of the cylinder, the tendency of which is to cock the crosshead at the end of the stroke.

Side-Rod Bushings

Side-rod bushings have ever been a source of trouble due to rapid wear. The selection of bearing metals is one of utilizing a bronze that can be subjected to a higher working temperature than is now possible and, when used in connection with hardened crank pins, the wearing qualities can be increased, while seizure from operating temperatures and lack of proper lubrication will be practically eliminated.

Driving Boxes

Driving boxes, as designed at present, have not sufficient sustaining qualities for the application of a pressed-in crown brass, due largely to the limitations of present pedestal spacings, all of which can be modified by the elimination of shoes and wedges.

The use of present shoes and wedges is to take care of wear of the box, liners and shoes. To minimize this wear so that they will operate between shoppings within prescribed tolerances will necessitate the use of nitrided-steel wearing surfaces. Furthermore, the use of shoes and wedges often creates improper transverse alinement, or parallelism, of driving axles, which, if eliminated, simplifies shop operation.

The design of box could, therefore, be modified by utilizing a portion of the thickness of the present shoes, wedges and floating liners by increasing the overall width. The wearing surface of the driving boxes and pedestal fit should be a flanged liner on both pedestal and box, made of manganese steel not less than 3/16 in. thick, the life of which should not be less than 200,000 miles.

Such a design would permit the use of a crown brass more rugged in design which can be applied without pressure so that replacement is simplified and present costs minimized.

The ever-increasing lateral between driving box and wheel hub can practically be eliminated by the application of nitrided-steel liners, inserted in a recess in the hub of the driving wheel and welded on the periphery, in conjunction with a similar liner inserted in the face of the driving box, the hardness of which should be approximately 850-950 Brinell. Such liners, when coming in contact, either lubricated or non-lubricated, should be good for 200,000 miles.

Driving Axles

Locomotive axle failures are an increasing difficulty and expense. There are two types of failures. The one type is a fatigue crack starting in the fillet next to the wheel center. This type of failure generally starts in a rough finished fillet, or where the brass cuts a shoulder in the fillet. Anything that will produce a notch effect on the bearing surface of the axle will start a crack that will progress until the heavy starting torque and the bending moment on the axle when the crank pin passes over the center will produce enough strain to rupture the remaining portion. The second type is one of hot boxes which produce thermal checks on the journal surface, and these are starting points for progressive fractures.

Anything that would relieve the axle of the duty of

supplying a wearing surface in addition to resisting the high fiber stress due to flange pressures would prolong the life of the axle. Axle bushings of nitrided steel, shrunk onto the axle, are now being tried out in testing laboratories. There is no reason why a pair of wheels, when mounted, should have journals re-turned to true up worn surfaces. A pair of driving-wheel centers properly mounted on a nitrided steel axle, having journals hardened or bushed, together with nitrided-steel crank pins properly quartered, should never be disturbed except for the replacement of tires.

Locomotive Links and Motion Parts

Locomotive links, the design of which has not been altered for many years, require continual regrinding due to the movement of the block. If made of nitrided steel if used in conjunction with a hardened block having a Brinell of 500-600, regrinding can be eliminated.

When one considers the importance of proper steam distribution, the ideal valve motion, irrespective of type, would be one in which all parts would never require any adjustment due to wear of pins and bushings. Here again the utilization of nitrided steels will go a long way toward establishing a greater degree of accuracy and more perfect steam distribution than is now possible.

Spring Rigging

The function of a spring rigging to take care of track irregularities, tire wear, etc., and the proper distribution of weights on the running gear. Consequently spring design and materials selected play a most important part. The gradual elimination of the present elliptic spring and the adoption of a different form of spring suspension than used at present, together with a re-design of the hangers that will eliminate wear and preserve the alinement of the locomotive, irrespective of tire or crown-brass wear, is in order. There is no good reason why the designing and manufacturing of locomotive springs should not follow automotive practice.

From the foregoing it will be observed that there is opportunity for radical departures from present-day practice and, unless those directly interested in engineering principles covering locomotive design change their viewpoint in the utilization of ideas and materials used so successfully in other lines of industry, we shall be unable to profit from the progress which has been made in those industries for our own use, as a possible means of decreasing maintenance.

Wheel Centers

The design of wheel centers and the character of steel used is a subject that requires more research.

Taking a concrete example, specifications require that all steel castings must be annealed so as to relieve strains introduced during cooling. This seems to be a universal practice. On the other hand, we take a wheel center, press it on an axle, introducing compressive stresses in the hub which may or may not be transferred into the spokes, and then press in a crank pin, the stresses of which go into the hub and spokes, and finally shrink on a tire, which not alone compresses the rim, but likewise the spokes, the result of which is a wheel center having all sorts of internal stresses. As a matter of fact, it is stressed far in excess of any stresses that may have been introduced originally during the casting and cooling process. We still insist that those stresses must be removed but nothing is said of the stresses of the completed article.

It would seem, therefore, that tests are in order calling for the application of extensometers on spokes, hubs and rims, covering all of these operations for the determination of stresses, or for the possible redistribution of metal, if it is found necessary, to take care of those stresses, which should assist in furthering the life of our present wheel centers.

Locomotive Tires

Present practice in locomotive tires, or for that matter any tired wheel, irrespective of size, calls for three grades of material; namely, *A*, *B* and *C; A* used in passenger service, *B* freight service, and *C* switcher service, representing graduated increases in carbon content and, consequently, hardness to resist wear. These materials have undoubtedly stood the acid test for a good many years. There is a question, however, among metallurgical engineers as to whether the railroad engineering profession has not overstepped its limits with respect to wheel loads, taking into consideration the small contact area that a tire makes with the rail.

This subject undoubtedly covers a great many years of intensive research, primarily metallurgical, but limited in engineering considerations, as mass has not been considered an important item where fluidity of metal (due to great pressures) is concerned. It is believed that better results could be obtained by increasing the thickness of a tire over the conventional thickness so as to have more backbone in assisting the transmission of weight to the rail and, naturally, giving more life on account of this additional thickness.

Toughness in tire materials is a determinant in wear resistance, but, unfortunately, in ordinary tire steels toughness is only obtainable by increasing the carbon content, which produces a material of improved wearing characteristics but of a hardness with increased tendency to fracture under shock stress. However, with the change in speeds of freight locomotives narrowing the gap differentiating from passenger operating characteristics, it is felt that we can use the harder *B*-grade tires for all *A*-grade purposes.

Further, to meet the demands of maximum hardness and high tensile and elastic limit to resist flowing tendencies under heavy wheel loads, and to advance the service life of tires to meet the possibilities of increased life in other wearing parts, considerable attention should be given to the development of alloy steel for tires. Tires are now being used with nickel and manganese content, giving harder wearing surfaces without the brittle tool-steel characteristics of high-carbon tires. The surface as yet, however, has only been scratched.

Firebox Steels

The major problem in the selection of steel for fireboxes is one of temperature and requires a steel that will resist whatever the maximum temperatures of a firebox may be (under various operating conditions) so as not to break down the structure of the material. This, in itself, is quite a large contract, and various grades of steel have been tried with varying results, but not with sufficient assurance that their adoption would eliminate all of the troubles now experienced. It would, therefore, appear that one of the major problems is one of design in which the flow of gases over the arch will be similar to the flow of water over a dam; that is, straight line movement. The influence of the draft-producing medium at the center of the smokebox undoubtedly causes a stream flow of the gases converging toward that center, thus materially lessening gas flow and heat transfer away from the center of the tube sheet, all of which has a tendency toward creating hot

spots in the firebox, rather than maintaining a uniform temperature throughout.

Furthermore, the percentage of carbon in firebox sheets is believed to require careful consideration and should be a minimum—excluded if possible, as any carbon content unnaturally must have a hardening influence when heated and cooled, sometimes abruptly, under the present operating conditions. Experiments are now being conducted with a brick side-wall lining to determine the effect of controlling the rapidity of temperature change by a more uniform heat distribution.

Grates

The design of grates and the selection of a material that will resist heat at higher temperatures than any material now in use would be a step in the right direction, although grates may be so designed that its section may be sufficient to reduce the temperature at the top of the grate well within the confines of the critical range of the material by the net area and distribution of the air inlets. This, however, requires some experimentation for determination.

Staybolts

Design likewise should more fully enter into the staybolt situation, rather than the mere selection of better material, or type of material. The entire firebox, were it not for the attachment of the firebox sheets to the mud ring, is a floating chamber supported by staybolts. The water legs, increasing in width from the mud ring to the crown sheet, with the space between the crown sheet and the wrapper sheet being in excess of that of the widest width of the leg, calls for staybolts of varying lengths, but practically all having the same diameter.

Considering the staybolt as a cantilever beam, that is, by assuming that there is no movement of the wrapper sheet relative to the firebox sheet, the number of pounds required to deflect a long staybolt is naturally less than that of a short staybolt having the same diameter. Consequently there are zones in each firebox side sheet that are restrained, due to the constant force of expansion at uniform temperatures, by the shorter bolts not deflecting the same amount as the longer ones which produce stresses within the sheets that in time will produce hair line cracks around staybolts. Eventually failures result.

As a suggestion, or at least as something to think about, why not divide the application of staybolts in a vertical plane into horizontal zones and design the staybolts in certain zones according to their length by assigning diameters so that all staybolts may deflect uniformly, assuming that the expansion force is constant.

Tank Steel

The selection of materials likewise can be extended to the use of tank sheets instead of present open-hearth steel. Even though copper-bearing steels are being used to a very large extent, other materials can be procured in which corrosion can be eliminated and, therefore, the initial cost can be justified, considering the elimination of tank repairs which are now prevalent.

It also would be helpful in designing the slope sheets to have the joints made on the vertical sides instead of where the slope sheet coincides with the side sheets, and providing at least a 6-in. or 9-in. radius in the corners. This would not only assist the coal in passing to the conveyor more freely, but would prevent the corrosive elements from entering the joints made in present-day construction.

Design As Important As Materials

The utilization of alloy steels is not the only attack on maintenance. The best of engineering practices and industrial arts must be drawn upon in the development of integral designs to replace built-up assemblies for the purpose of realizing maximum strength and reducing wear and tear at joinings. This is strikingly exemplified in the design of the integral bed frame for a locomotive foundation.

This represents a radical and bold departure from past practices, yet experience has now been sufficient amply to justify the design.

It is believed that the money expended for the initial cost of using nitrided steel and the other special materials referred to as a means of decreasing maintenance will be more than justified in the subsequent reduction in maintenance cost and lesser loss of service of locomotives held for maintenance. An accounting system should, if necessary be developed by which the cost of repairs or replacements of individual details of each class of locomotive can be recorded for easy reference and to serve as a source of reliable reference data to substantiate the foregoing belief.

In conclusion, it might be well to emphasize the wonderful possibilities in design in conjunction with the utilization of high-grade material, which the railroad engineering profession should consider, as the selection of steels is only a portion of the problem.

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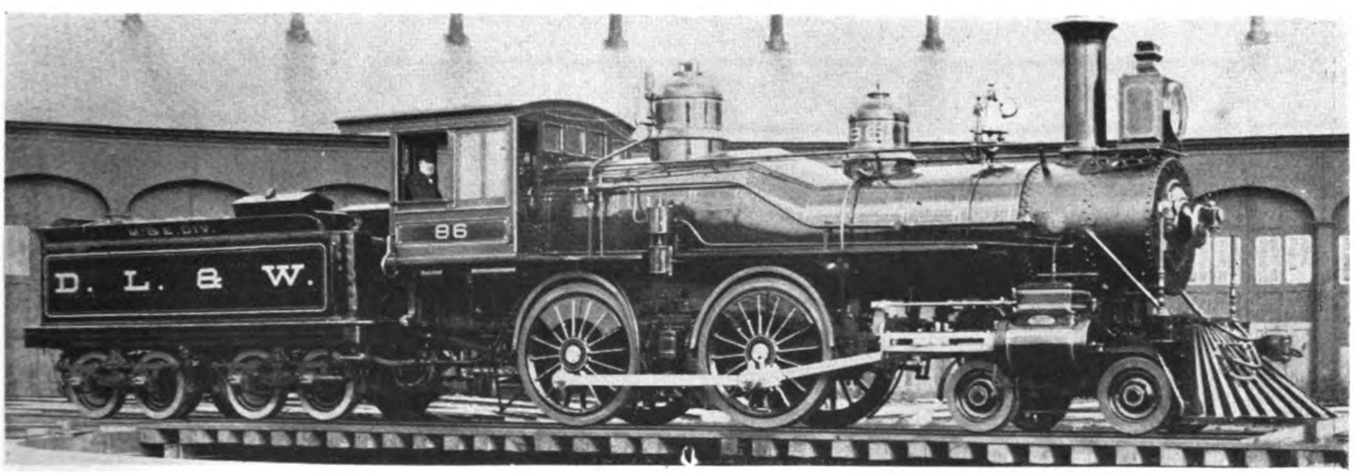


From Collection of George M. Sittig

Delaware, Lackawanna & Western 4-4-0 type locomotive built by the railroad at its Kingsland, N. J., shops

Illinois Central Improves Locomotive Drafting

The Mays front end, using inside stack extension and basket bridge, effects a reduction in unit coal consumption in passenger service of over 9 per cent

BEGINNING in the latter part of 1929, the standard front-end arrangement, used on Illinois Central locomotives, was restudied, certain fundamental changes suggested and a new non-patented design developed which has been shown by comparative service tests to provide ample draft coupled with minimum back pressure, relatively low fuel consumption and greatly increased locomotive efficiency. The new arrangement, called the Mays front end because of the personal-interest taken in it by F. R. Mays, the present general superintendent of motive power, has already been applied to about 1,000 Illinois Central locomotives.

Referring to the drawing, the general arrangement of the new design is shown. The exhaust nozzle diameter is increased from 6⅜ in. to 7⅜ in. in the case of Mountain-type locomotives, such as the I. C. 2400 class. It will be observed that the upper end of the petticoat pipe fits closely in the smoke stack, and overhead draft is thus dispensed with entirely. The lower flared end of the petticoat pipe is 30 in. in diameter and extends to within 13½ in. of the table plate. The most outstanding change called for by the Mays front-end arrangement is in the exhaust-nozzle bridge. The old split bridge, used for many years, was for the purpose of splitting the exhaust steam into two parts to fill the stack and thus create sufficient draft. The Goodfellow exhaust tip and basket-bridge arrangement, illustrated, has been shown to break up the steam jet more thoroughly by splitting it into four parts, thus completely filling the stack and, by a more effective entrainment of the gases with the steam jet, creating an equal and more uniform draft with a substantially larger nozzle opening and greatly-reduced back pressure. The bridge, itself, is made of two crossed bars of ½-in. round case-hardened steel, set at 45 deg. to the locomotive center lines. The adjustable diaphragm or baffle plate in front of the exhaust pipe has been removed and a clear opening of 20¼ in. measured vertically is maintained on this class of locomotive.

Analysis of Kentucky Coal Used in Test Runs

	Car No. 401253	Car No. 400656	Car No. 400138	Car No. 127529
Moisture	.94	.95	1.19	1.18
Volatile combustible	35.27	39.30	37.26	38.52
Fixed carbon	48.45	52.43	50.35	50.15
Ash	15.34	7.32	11.20	10.15
Sulphur	3.49	3.52	4.90	3.49
B.t.u.	13,350	13,500	12,310	13,250

Particular attention was paid to conditioning locomotives in advance of the tests. The exhaust pipe and nozzle were lined up carefully with the center line of the stack, the seat of the nozzle on the exhaust pipe and the seat of the exhaust pipe on the cylinder saddle being checked for tightness by a water test. Also all superheater units, flues and the front end were similarly checked for leaks. The mechanical condition of locomotives as regards cylinder- and valve-packing wear, valve setting, etc., was carefully checked and brought up to standard. The brick arch, bearing directly against the flue sheet, was examined to assure its being in good condition.

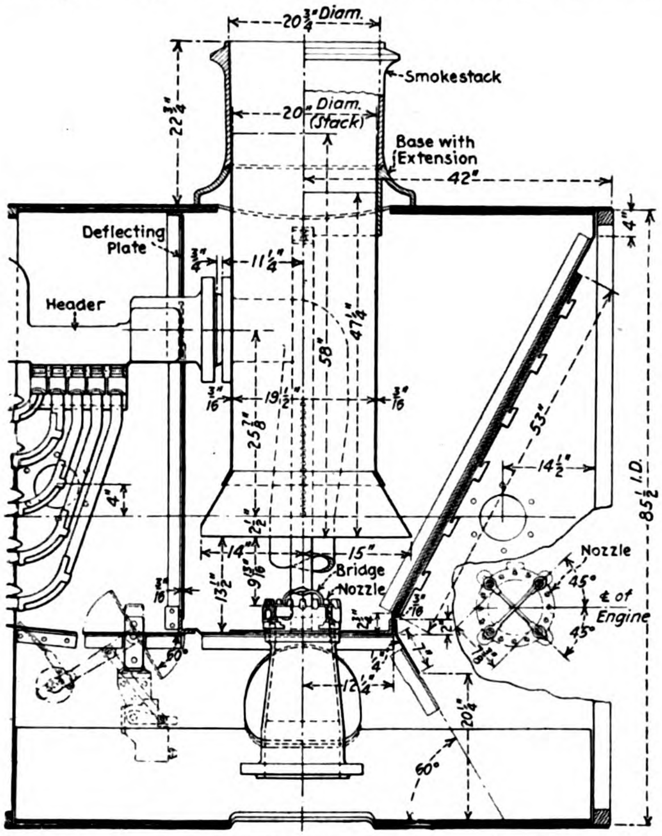
Comparative Dimensions of Old and New Drafting Arrangements

	Former drafting arrangement	New Mays drafting arrangement
Diameter of nozzle tip	6⅜ in.	7⅜-in.
Bridge	¼-in. knife blade	½-in. basket
Petticoat pipe over table plate	18¼ in.	13½ in.
Petticoat pipe inside diameter	18 in.	18½ in.
Overdraft	3 in.	0
Draft sheet over smokebox at center	17¼ in.	20¼ in.
Arch	Sealed	Sealed
Number of brick in arch	8 center, 7 sides	7 center, 6 sides
Protection grates	Slotted	⅛-in. plates with ½-in. holes, slots

During April and May, 1931, a series of comparative service tests of front ends was conducted, using Illinois

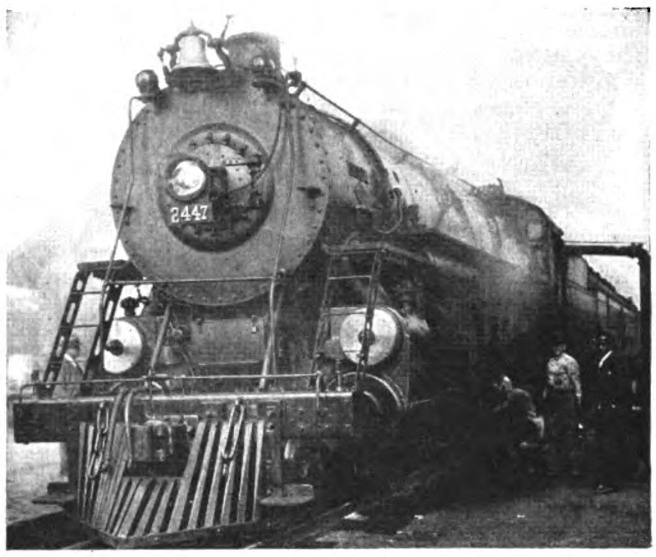
Test train hauled by locomotive equipped with Mays front end

Central Locomotive 2447 in regular passenger train service between Memphis, Tenn., and Canton, Miss., a distance of 187 miles. This territory was chosen because of the uniform temperature and wind conditions and generally favorable grades which are a maximum of 1.22 per cent northbound and 1.25 per cent southbound. The capacity of the locomotive tender was 18 tons of coal and 10,000 gal. of water. Track scales were available at both initial terminals for weighing the tender in determining the amount of coal used. With the tender capacity stated, it was unnecessary to take coal en route. With a tank capacity of 10,000 gal. water was taken only once en route. The same locomotive crew was used during all tests.



General arrangement of Mays locomotive front end—Insert shows plan view of exhaust nozzle and bridge

The fuel consisted of Kentucky coal of relatively high B.t.u. content, special precautions being taken to assure uniformity. This coal was all received from one vein of the Graham mine, Kentucky. It was loaded in four cars and kept protected from the weather. An analysis of the coal in the four cars showed its general uniformity, with heat content varying from 12,310 to 13,500 B.t.u. as indicated in the table.



Test locomotive 2447 taking water once en route at Grenada, Miss.

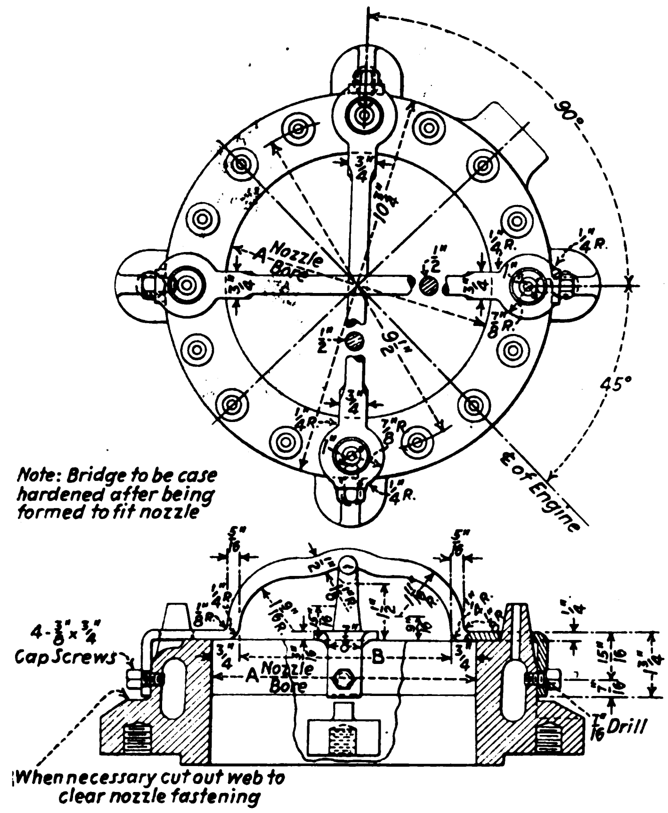
Coal was taken only at the initial terminal on a total of six northbound and six southbound trips. The locomotive tender was weighed on track scales at the initial and final terminals by removing a wedge from between the locomotive and tender so that it would be free. Identification marks on the track scales permitted spotting the tender in the same location each time the tender was weighed. Water taken at the initial terminal on each trip and again at Grenada, Miss., was measured by previous calibration of the tender in inches at the left front and right back corners.

Comparative Tests of Illinois Central 4-8-2 Type Locomotive No. 2447, Equipped with Old and New Drafting Arrangements*

Trip Number	Number of cars	Car miles	Lb. of coal consumed per 100 p.c.m.	Lb. of water used per 100 p.c.m.	Lb. of water evaporated per lb. of coal	Running time Hr.	Running time Min.	Average running speed, m.p.h.	Depth of fire, in. Leaving	Depth of fire, in. Arriving	Condition of fire at end of trip
SOUTHBOUND TRIPS											
1†	11	2,057	1,004	5,684	5.66	3	36	51.9	6	21	Bad
3†	9 to Grenada, 8 to Canton	1,595	1,268	7,319	5.77	3	31	53.0	6	11	Fair
5†	8	1,496	1,338	7,133	5.33	3	40	50.9	6	21	Bad
Average	9.2	1,716	1,203	6,712	5.59	3	36	51.9	6	17.7	
7‡	8	1,496	1,180	6,856	5.81	3	36	51.9	5.5	9	Good
9‡	8	1,496	1,094	6,730	6.15	3	38	51.5	7	9	Good
11‡	8	1,496	1,035	6,444	6.22	3	43	50.3	5	9	Good
Average	8	1,496	1,103	6,677	6.06	3	39	51.2	5.8	9	
NORTHBOUND TRIPS											
2†	8	1,496	1,221	6,986	5.72	3	41	50.8	5	20	Bad
4†	8	1,496	1,151	7,307	6.35	3	44	50.1	5	13	Fair
6†	8	1,496	1,066	6,933	6.50	3	41	50.8	6	13	Fair
Average	8	1,496	1,146	7,075	6.19	3	42	50.6	5.3	15.3	
8‡	8	1,496	986	6,265	6.35	3	41	50.8	6	9	Good
10‡	8	1,496	1,027	6,329	6.16	3	41	50.5	6	10	Good
12‡	7	1,309	1,077	6,970	6.47	3	42	50.5	7	8	Good
Average	7.7	1,434	1,030	6,521	6.33	3	41.6	50.6	6.3	9	

* Tests made on Panama Limited runs between Memphis, Tenn., and Canton, Miss., 187 miles, using Kentucky coal.
† Locomotive equipped with former drafting apparatus.
‡ Locomotive equipped with Mays drafting apparatus.

The locomotive was equipped with a steam-chest and back-pressure gage in duplex form, mounted in the cab, readings being taken on passing each station other than where stops were made. The steam-chest gage pipe was tapped into the right steam pipe and the exhaust gage pipe into the exhaust space of the right valve chamber at each end by means of a branch connection. All gages were tested at the beginning of each test. The amount of superheat temperature was measured with the use of a standard pyrometer gage, also tested at the beginning of each test. The depth of fire in the firebox was estimated by means of narrow steel strips welded to the firebox sides at distances of 6 in., 12 in. and 18 in. respectively above the grates.



Details of exhaust nozzle and tip arrangement used with Mays front end

The results of these tests are summarized in the large table which shows a reduction in coal consumed per 100 passenger-car-miles from 1,203 lb. to 1,103 lb., or 8.3 per cent, southbound and 1,146 lb. to 1,030 lb., or 10.1 per cent, northbound. This is an average of 9.2 per cent saving in both directions, due to installation of the Mays front end. The saving per 100 passenger-car-miles, placed on the basis of an equal number of cars, is 12.0 per cent southbound and 12.1 per cent northbound, or 12.05 per cent average saving, in both directions. By a similar process of calculation the saving in pounds of water evaporated per pound of coal is found to be 5.1 per cent on the average in both directions. The fire was burned more uniformly and fewer cinders were thrown from the stack.

The maximum back pressure observed in these tests with the locomotive operating at 40 per cent cut-off on grades was 8 lb., which may be compared with 18 lb. with the old standard front end. The maximum back pressure noted at any of the regular test observation points, however, was only 3½ lb., at which time the locomotive was operating at 60 m.p.h. and 30 per cent cut-off with a boiler pressure of 198 lb. and steam-chest pressure of 192 lb. This reduced back pressure in addition to increasing the efficiency of the locomotive substantially, results in lower water consumption and reduced maintenance of machinery.

The average cost per locomotive for changing the front ends is $25.

I. C. Develops Unit Car Cost System

(Continued from page 482)

to the superintendent of the car department, the work performed on the car is divided into the following groups: Stripping, body work, truck work, air-brake work and painting.

With this information, comparisons of work performed at various shops are readily available; the local foremen are in position to locate inefficient units and to determine the cause for any apparent variation between the average cost for the current month and that of previous months. In many cases, too numerous to mention in detail, the unit cost system has been directly responsible for pointing the need for improved machines and labor-saving devices, a few of which will be described in subsequent issues of the *Railway Mechanical Engineer*.

The original record of repairs is filed numerically at local shop points and the information, transcribed to railroad Form CD-46, is transmitted to the superintendent of the car department in whose office it is entered on railroad form No. GSMP 221. The latter form, an office card record, offers space sufficient for recording ten shoppings.

The routine followed in handling the unit repair-cost system at the general office is as follows: (1) Transcribe the number of cars turned out of shop as reported on daily Form 1239, car shop report; (2) compile the daily output report for each shop with the total amount of money spent, for current information of the car department superintendent; (3) make a daily record of output by series; (4) check the report of cars turned out of shop and insert opposite each number reported the cost information daily; (5) transcribe the cost information to the office car record, GSMP Form 221, from daily transmittal Form CD-46; (6) file the record cards in the cabinet; (7) at the end of each month, compile cost figures by series, cost figures by class of repairs, and show total amounts spent on classified repairs; (8) make an entry on the key card for each series monthly; (9) make a progressive statement of cars given classified repairs in comparison with the three-year repair cycle; (10) make a statement of the cars repaired by kind, classification and shops for purposes of comparison.

With the above information available in the general files, the superintendent of the car department is in a position to determine the amount spent during any given month for classified repairs, the amount spent currently on any given series of cars or any given group of cars, and by striking averages he can closely estimate appropriations required in repair programs or the cost involved in repairing certain series of cars.

The railroad classification of repairs is determined by the amount of money spent for repairs, whereas the American Railway Association classification is determined by the man-hours involved. With the cost system described, the Illinois Central is in a position to render accurate reports in this respect.

Can the Car Departments Solve These Problems?*

By T. W. Demarest †

Repair tracks are badly located; types of new cars are not always well selected; bad construction is still a burden on expenses; standard cars remain largely on paper

I FEEL safe in saying that too many light-repair tracks are improperly located; that in most transportation-yard layouts, consideration is given primarily to direct transportation operations only and if there is any property left it is assigned as a repair-track location; that the effect of such location on yard costs, additional shifting, delay in getting cars to and from the repair track, per diem, and delay to loads, is not given the consideration it deserves. At one time, it was thought that wheels or couplers could not be changed on a transportation-yard repair track, that to renew brake beams required the movement of the car to an outside track, and, that, in addition, we should carry on such light-repair tracks, heavy-repair cars to provide work for the men when they run out of light work. The viewpoint has changed completely in the past few years. We now realize that light-repair tracks should be a direct part of the classification yard, that bad orders should be shifted to them as a part of the regular breaking-up of the train, that the so-called outside light-repair track is only a place to hold wrecked cars to take care of transfers. A light-repair track as part of the classification yard also permits the use of the dead time of the inspectors.

Car Construction and Details

The increased length of trains, higher speeds, and the necessity of reduced maintenance costs bring most forcibly before us the desirability of a careful analysis, not only of general designs, but also of those details which cause the most trouble in running or current maintenance. Rapid changes in the character of the traffic being offered in some sections must be recognized by the roads involved when building new equipment. The construction by roads of types of cars for business not originating on their line is an expensive practice. This is now being regulated to some extent by advice from the American Railway Association, Car Service Division, in Washington, D. C. We have too many cars now—the problem is their better utilization. For further economies, we may analyze the situation from the following viewpoints.

Obsolete and Unduly Expensive Types—The continuation in service of obsolete types of equipment constitutes a continuous burden on expenses, not only on the owner, but also on others using lines. There can only be one reason for not cutting up such cars and that is that the depreciation charge practices by the car owners have been entirely inadequate, and, due to the resulting heavy charge to expenses, they cannot now afford to cut up the car. This situation is also developing in cases where old equipment received heavy betterments which were added to the book cost. The reaction is obvious—that depreciation rates should not be varied to produce net earnings. I am also of the opinion that, to meet changing traffic conditions, to eliminate idle investments and decrease the number of useless cars, the present depreciation rates as applied to freight cars are too low, and instead of being set up on the basis of a 40- to 50-year life, they should be figured on not over a 25-year life.

Expensive Types of Cars to Maintain.—We may have classes or types of cars which, in-so-far as capacity is concerned, are not obsolete, but, due to construction details, are too weak and are continual visitors to the repair tracks. If such cars have A.R.A. cast-steel side-frame trucks, the trucks, air brakes, couplers, and possibly draft gear may be salvaged and the cars rebuilt at the cost of new bodies and underframes only, producing cars which will meet all modern transportation conditions. If the above details cannot be salvaged, the disposition of the cars then reverts to the question of the amount of accrued depreciation.

Construction Details Causing Continual Maintenance.—It has been our opinion for a number of years that the construction details most seriously affecting running maintenance, and yard and road operations, were the car truck, together with its associated details (the wheels and axles and brake beams), the draft attachments and gear, and car ends. We can consider the case, as far as the truck proper, as being settled through the adoption of the A.R.A. cast-steel side frame, and the car end, through the application of steel ends. The friction draft gear is under consideration by the Coupler and Draft Gear Committee. There is no doubt that this detail should be materially redeveloped and its capacity increased. Further, its operating efficiency can be materially improved and maintenance costs decreased by periodical attention.

Wheels and axles are probably the major cause for the detention of loads through interchange territory—wheels on account of the various wheel defects and axles on account of cut journals, the latter amounting to approximately 25 per cent of the total wheels and axles removed. Cut journals may eventually be eliminated by the application of roller-bearing boxes, and, in the meanwhile, complete compliance with A.R.A. lubricating instructions. The number of wheels removed on account of the various wheel defects suggests the thought of modifying general car construction to permit the use of a larger-diameter wheel as well as a thorough investigation concerning the most suitable material for the wheel. It is evident that with increasing loads and increasing speeds, to better distribute tread and flange wear, larger-diameter wheels may prove a necessity. Brake beams, as far as the construction of the beam is concerned, have been well worked out. The suspension of the beam, however, (hanger,

* Part of an address delivered at the initial fall meeting of the Car Foremen's Association of Chicago, held at the Great Northern Hotel, Monday evening, September 14.

† Mr. Demarest is general superintendent of motive power of the Pennsylvania Western Region. He is also chairman of the Arbitration Committee of the Mechanical Division, A.R.A.

hanger pin, and hanger-pin brackets) is open to much improvement.

A recent investigation into the cause for the damage to hung meat in refrigerator cars established the cause for the damage as being due to the character of the spring suspension in the trucks. The coil spring is in almost universal use for this purpose and its quick harmonic vibrations set up continual jars which finally tear the meat from the hooks. These strains must also affect the car structure. While eventually elliptic springs may be substituted, a new truck design must be evolved. For the present, the situation may be met by the use of any one of a number of approved spring dampeners.

Adoption and Construction of Standard Cars.—It seems idle to discuss the economies which will result from the construction of new equipment by all railroads, limited to A.R.A. standard cars. The question of material stocks, ability to make quick repairs, and the decreased cost of new equipment from the car builders, constitute sufficient reasons. The inertia of the railroads, themselves, comparatively minor differences in construction and dimensions based on individual opinion, and perhaps the influence of the traffic departments, have restricted the more general construction of such types as have been adopted. It is going to take direct action and complete agreement on the part of the railway presidents, themselves, to get results in this particular.

Type of Car to be Constructed.—There is a surplus of freight cars in the United States, as well as a surplus of locomotive. The allocation of cars to the various districts is regulated by the Car Service Division. It would appear that the Car Service Division has a more nearly accurate picture of the type of car required for general use than the individual railroad could have. They should have also a pretty broad picture of the changing trends in business. Why would it not be advisable, therefore, when a road contemplated the construction of new equipment, to consult with the Car Service Division? I understand that some roads have already done this with the result that they did not build the type of car originally contemplated.

Welding—Use of Light-Weight Alloys

At this point, we may refer to a possible decrease in construction costs in all-steel equipment brought about by welding seams instead of riveting. In the use of this process, including some changes in design, the Pullman Company recently on five 70-ton hopper cars built for the Chicago Great Western, effected a saving of 8.6 per cent in tare weight and an increase in the cubical capacity of the car of 8.9 per cent. The effects of corrosion should be materially reduced, due to decrease of water pockets. The cars were tested under impact with strain indicators and the design so modified as to produce uniform stresses in those parts subject to buff and pull, which should result in a stronger car and a more economical car to maintain. We believe some roads have made some use of this welding process in car construction.

Some one estimated at one time that the Panama Canal could be built for the cost of hauling the tare weight of the freight and passenger cars moved in the United States in one year. While we have in no way endeavored to confirm these figures, it is quite evident that any reduction in tare weight permits the equivalent handling of that much additional paying load without increase in locomotive draw bar pull. While some saving can be made by the use of alloy steels, the return would probably not be sufficient to justify the cost and, consequently, engineers are looking forward to the development and application of aluminum alloys. Today such alloys with tensile properties comparable with structural steel and weighing only one-third as much as the latter are available. The Illinois Central were probably pioneers in this direction, starting in 1923 on trailers in their suburban equipment. In 1926, the Pennsylvania carried the aluminization of suburban cars even further, realizing a weight reduction of 10½ per cent. In street railway service, the application has been carried still further and a 30-per cent reduction in tare weight realized.

The application to freight service has been quite limited, perhaps only to the tanks of a few tank cars, and primarily, I believe, on the basis only of handling products that react chemically on steel. Present relative costs of the two materials may interfere with any rapid substitution of aluminum alloys for steel in freight-car construction (except special cases) for some time to come, but increased demand will eventually bring the two costs closer together.

Effect of Possible Railroad Consolidations

The consolidation of different railroad organizations, just as the consolidation of smaller roads into the present systems, would naturally bring about many of the suggestions we have been discussing. Inspection and interchange points would be reduced or eliminated. Class or general repair shops would be consolidated. Material stocks would be reduced, and the operation of standardized equipment inaugurated. If these results, all promoting economy, are possible and practiced on systems, and are possible and can be practiced on consolidations, why are they not practicable as between different railroads? At the last meeting of the Mechanical Division of the American Railway Association there was a most thorough discussion as to the possibility of reducing the cost of car-repair billing through the elimination of the clearing houses maintained by the individual roads, the establishment of central clearing houses to be used by various combinations of roads, and the possibility of pro-rating the cost of car repairs in the district on the basis of the per diem use of cars by the individual roads. The method to be adopted to promote this economy is before the Arbitration Committee. There is no solution as yet. We believe it is a fact that for purposes of use the freight-car equipment of the United States is practically pool equipment. This being true, why should it not also be pool equipment for maintenance? If the American Railway Association, through its Car Service Division controls the location of cars for use, why should they not also have direct control over all interchange practices, over all freight-car repair billing, and over the construction of new equipment? I am afraid that centralized control is the only method which may be applied with the hope of being able to produce results.

First Roller Bearing Train.—When the Merchants Limited consisting of 12 Pullmans and 2 diners, and hauled by the Timken Roller Bearing Company's experimental locomotive No. 1111, made the 156.8 mile run from New Haven, Conn., to Boston, Mass., recently, with a similar return run on the following day, the New York, New Haven & Hartford earned the distinction of being the first railroad in the world ever to operate a train completely equipped throughout with roller bearings. Although there have been numerous other instances where all the cars of a train have been equipped with roller bearings, and, although the Merchants Limited is not the first passenger train to be hauled by the Timken locomotive, this is the first time that the locomotive has pulled a complete train of cars, all of which were equipped with roller bearings.

Death Claims Colonel Edward A. Simmons

Publisher of the Railway Mechanical Engineer, Railway Age and other papers dies at the age of 56, after 42 years of association with publications in the railroad field

Edward Alfred Simmons

COLONEL EDWARD A. SIMMONS, president of the Simmons-Boardman Publishing Corporation and affiliated companies, publishers of *Railway Mechanical Engineer,* died of a cerebral hemorrhage at his home in Brooklyn, N. Y., on September 30. Colonel Simmons was in his fifty-seventh year and had been continuously associated with the Railway Age and its predecessor publications for 42 years, having as a youth of 14 joined the organization he later came to head.

Edward Alfred Simmons was born in Brooklyn, N. Y., on March 20, 1875, and was educated in the public schools of that borough. He entered the service of the Railroad Gazette in a subordinate capacity in September, 1889. His ability being quickly recognized, it was not long until, in spite of his youth, he had attained an important post on the sales staff of the magazine, from which he was subsequently promoted to the business managership. On June 1, 1908, Colonel Simmons effected the merger of the Railroad Gazette with the Railway Age (Chicago), and in 1911 he became president of the company which had been formed to take over the properties. This company, under his leadership, also initiated or acquired the following transportation periodicals: *Railway Mechanical Engineer;* Railway Engineering and Maintenance; Railway Electrical Engineer; Railway Signaling; Marine Engineering; The Boiler Maker and Airway Age. In 1926 the Railway Review was acquired and combined with the Railway Age.

In 1929 the Simmons-Boardman Publishing Corporation was formed under the presidency of Colonel Simmons, acquiring control of all the transportation papers heretofore mentioned, and in addition thereto the American Builder and the House Furnishing Review. With the American Builder have since been combined the Building Age and several other publications in that field, giving it a position of eminence comparable to that attained by the Railway Age and its sister publications in their service to the railway industry.

During the World War, Colonel Simmons served with the Quartermaster Corps, being commissioned a major in 1918. After the war he was elevated, first to a lieutenant-colonelcy and then to a colonelcy, in the Officers' Reserve Corps, Quartermaster Section. He took a keen interest in military affairs and was a member of several military societies. He was prominent in the work of the American Legion, of which he was past commander for Kings County. He served a term as president of the Brooklyn Chapter and another as president of the Department of New York of the Reserve Officers' Association of the United States. He was a member of numerous clubs, principally in New York, Philadelphia, Washington and the Adirondacks. At the time of his death he was a member of the board of governors of the Railroad Club of New York.

Always maintaining an active interest in railway affairs, Colonel Simmons was likewise identified with engineering and marine matters. An associate member of both the American Society of Mechanical Engineers and the American Society of Civil Engineers, he served as chairman of the endowment committee of the Engineering Foundation, Inc. He was a member of the Society of Naval Architects and Marine Engineers, and chairman of the American Marine Standards Committee. As a publisher he took a keen interest in that business, was widely acquainted among its leaders and active in co-operative endeavor looking toward its welfare. Among his business interests, in addition to that as a publisher, was that of machinery manufacture. He was chairman of the board of the American Saw Mill Machinery Company and president of the American Saw Works, and occupied both these executive posts in the American Machine Tool Company.

Colonel Simmons' career was an ever-expanding one. Each year brought enlargement to his business and civic activities, involving a pressure of work which doubtless latterly put a strain upon even such a vigorous constitution as was his. He was chairman of the United States delegation to the International Railway Congress at Madrid in 1930 and was actively identified, although always in a lay capacity, with political affairs both local and national. A lover of outdoor life, he served as president of the New York State Division of the Isaac Walton League of America, and his happiest hours, when business duties permitted, were spent with his family in the Adirondacks, where at Eagle Bay, on Fourth Lake, his country seat, Albedor, is located.

EDITORIALS

Engine Terminals Do Their Bit

In the present emergency, locomotive terminals have come to the front as one of the most important factors enabling the railways to weather a depression never more acute than now. Shops may remain closed but the terminals must carry on. A general master mechanic steps down to a master mechanic's job on a road that has just abolished many general office positions. During the ten preceding years in which he served as a general officer including in his terrtiory the division on which he is now master mechanic, he fought continually for better terminal facilities. He refused to wash locomotives in enginehouses where hot water was not available, he condemned terminals in which no water-treating facilities were provided, he belaboured the management with figures showing the cost of operating hand-shovel cinder pits, he complained over the inadequacy and expense of old timber coal trestles. He seized upon an electric car puller from a dismantled coal trestle and had it installed for turning tires by drawing the locomotive over a piece of track while cutting tools were applied to dummy brake heads.

Now that he is back on the firing line, he finds the situation has changed. During the past ten years his road has provided every main-line enginehouse with a hot-water boiler-washing plant and has supplemented this with facilities for direct steaming locomotives at terminals where stationary boiler capacity is adequate and power plant coal is available at a lower cost than locomotive fuel. A continuous system of water-treating plants has been installed along the main line. Automatic, electrically-operated cinder plants have replaced many hand-shovel pits and modern mechanical coaling stations with ample overhead storage have almost entirely supplanted the coal trestles. The master mechanic's chickens have come home to roost. He has facilities to work with from which he can get results even under a regime of the strictest economy ever enforced by this road. Asked by the vice-president how long he could keep his power in shape before it would be necessary to reopen the shops, he replied with confidence, "Two years, assuming a continuation of the same volume of business and no further cuts in my terminal expenditures."

The addition of new locomotives during the last ten years coupled with the splendid general condition of motive power established prior to the current period of depression has helped immeasurably as a reserve against the extreme economy now applied to maintenance expenses. Yet there is a limit to which good power can thus be drawn upon. When this limit is exhausted, the terminal becomes the next line of defense. Railways that have modernized their terminal facilities along with the acquisition of modern locomotives and have not allowed the organization at these terminals to become disrupted by too great a cut in forces, have the reserve capacity for maintaining their locomotive in condition for many months to come. Out of this crisis, the locomotive terminal will emerge as an operating factor of no lesser importance than the locomotive itself. With ample modern power for all principal services, the next important step is modern terminals throughout.

Car Cost System Gets Results

Elsewhere in this issue is an article describing the Illinois Central unit freight-car-repair cost system, which has been in effect on this road since January, 1930, and has provided an effective control of car-repair operations not possible before. By this system, a description of which in considerable detail is provided in the article referred to, an accurate record of the amount of labor and material expenditures for each individual car given classified repairs is made available without greatly-increased office or clerical work, the bugbear forestalling most previous attempts to set up individual car records. It is believed that this is the first time a plan has been devised to keep such records by any road owning an amount of equipment comparable to that of the Illinois Central.

It seems well worth while to re-emphasize the high points and advantages of this unit car cost system which shows not only the detail material expenditures and labor charges for each car, but for each major subdivision of the repair work, including stripping, body work, truck work, air-brake work and painting. By combining this information for each series or class of cars, the cost system provides data on which to develop car-maintenance programs intelligently and with a reasonable assurance that cost estimates will not be exceeded. It gives invaluable information regarding the performance and service results secured with various materials and specialties entering into car construction. It is of great assistance to the general office in answering questions asked by the management regarding practically any detail of freight-car condition and maintenance.

Since the detailed records originate at local shops, foremen at these points are in a position to analyze costs and take steps to eliminate lost motion. By knowing the cost of actual operations at each of the positions in the progressive line-up of the repairs, for example, foremen can place their finger on those positions which may be overmanned or have some inefficient method of handling material or performing the work. Attention is called to inefficient machines and the necessity for labor-saving devices, many of which have been developed as a direct result of the installation of the cost system. The shop output is balanced by balancing the output of individual groups and a friendly competition is stimulated between these groups, resulting in a marked improvement in shop operation. In some cases, the average labor per car given heavy repairs has been reduced nearly 40 man-hours. The inter-shop departmental competition is also extended to various shops on the system, with a decidedly healthful tendency toward the elimination of undesirable conditions at any one shop by the introduction of methods or machinery

which have been shown to produce the desired results at other points.

The installation of the unit freight-car cost system on the Illinois Central is credited with causing foremen to give more attention to material costs as any excess is immediately apparent and requires explanation. The foremen of the production departments, such as the mill room, wheel shop, blacksmith shop, etc., also have an incentive to save material, as well as labor. This results in ordering only such materials as are needed and can be used efficiently. There can be little question that the development of the unit freight-car-repair cost system on the Illinois Central, because of the knowledge this system gives of actual conditions and accomplishments, constitutes one of the most important recent contributions to greater efficiency in the car department.

Maintenance Conditions Have Changed

One of the most insistent facts of human activity is change. Notwithstanding the many evidences of this fact which are constantly before us, most of us are loathe to recognize their implications and actively or passively oppose progress in the methods of doing the things with which we are associated. Such opposition sometimes creates a deceptive appearance of stability, but in time the cumulative pressure of changing conditions becomes great enough to disrupt old methods and for a time readjustments follow with bewildering rapidity.

Such an accumulation of changes in conditions affecting locomotive maintenance has been taking place for years. Ten years ago the condition of the boiler was recognized as the factor controlling the shopping of most locomotives. The rapid extension of water treatment has since vastly improved the boiler feedwater supply, so that the boiler has practically ceased to be a weak point in the locomotive from the shopping standpoint.

Now the machinery of the locomotive must bear the responsibility for breaking the mileage and some improvements in mechanical construction, such as the locomotive bed casting, and improvements in lubrication are already beginning to be felt in reducing the cost, if not the frequency, of heavy running and class repairs. The improvements already coming into service, however, have barely scratched the surface of the possibilities. Developments in metallurgy have produced a variety of new materials, some of which seem especially well adapted to reducing wear. The Timken roller-bearing locomotive represents a bold experiment in building for long mileage life. Aside from the ultimately determined economic value of the roller bearings themselves, the changes in mechanical construction and use of wear-resisting materials which were introduced in this locomotive are a contribution to advancement which may have a marked effect on future locomotive construction.

Elsewhere in this issue will be found a stimulating discussion of the possibilities for the application to locomotives of what is probably the newest material in the wear-resisting field, which was presented by C. E. Barba, mechanical engineer of the Boston & Maine, in a paper before the spring meeting of the American Society of Mechanical Engineers. Not only does Mr. Barba present his own opinion of the possibilities of nitrided steel for use on various wearing surfaces of locomotive machinery, but he describes also some interesting steps in their practical determination which should receive the careful attention of everyone having to do with locomotive design and maintenance who believes that the last word has not yet been spoken with respect to steam locomotive development.

For almost the entire history of the steam locomotive loose fits and rapid wear have been accepted as inherently necessary and far more attention has been paid to providing means of taking up the wear than to reducing it to a point where adjustments would be of relatively little importance. Indeed, the apparent lack of consideration of the wearing life of locomotive bearings in this country drew from an English railroad officer, during a visit to the United States a few years ago, the comment that American locomotives were half worn out when they left the shops. That locomotives should be loose jointed is a tradition of American railroad development which probably owes its origin to the relatively poor surface and alinement of track which prevailed in this country for many years. Such track conditions, however, no longer prevail and there is no longer any reason why the locomotives should not be built to take full advantage of the vastly improved conditions of modern track.

Unfortunately, the acceptance in principle of the desirability of closer fits and of wear-resisting construction effects no reduction in the cost of locomotive maintenance. It requires those who have courage and vision to take the initial experimental steps which are necessary to determine the economic limitations both of materials and tolerances. A goal of mileage as high as interior boiler inspections will permit is worth such an effort to attain.

Placing Unfit Cars For Loading

Anything like an accurate estimate of the total loss which the railroads sustain, owing to the placement of unfit cars for loading, with the subsequent train delays, car transfers, damage claims and dissatisfied shippers would be well-nigh impossible to make. The records show, however, that for loss and damage due to defective equipment alone the actual expenditures in 1930 exceeded two and one-quarter million dollars. Take the perishable business, for example, which is now largely handled in scheduled trains with specified departure and arriving times. It does not take much of a delay to throw a car and load out of step, sometimes with serious results. Damage claims, as high as $1,500 a car, have been paid, as a result of a perishable commodity arriving at the market one day later than scheduled, after a drop in quotations which necessitated the disposal of the load at a substantially reduced market price.

In discussing this condition at a recent meeting of the Car Foremen's Association of Chicago, T. W. Demarest, general superintendent of motive power of the Pennsylvania, Western Region, and chairman of the American Railway Association Arbitration Committee, said: "I am practically prepared today to advocate, with the exception of loads destined to points inside the switching district, a complete reversion of the rules, compelling the delivering line, before interchange, to put the car and load in such condition as will permit it not only to go through interchange without delay, but to destination without delay." In proof of the practicabil-

ity of this plan, Mr. Demarest mentioned the results achieved in Chicago since December, 1930, when one perishable load was delayed for each 111 cars of perishables interchanged. By calling the attention of the delivering line to each individual case, the performance was improved each month until July, 1931, when only one car was delayed out of each 329 cars interchanged, and this without abrogating any of the interchange rules or attempting to move bad-order loads on a "record" basis.

Luxurious Appointments Covered with Dirt

One of the bright rays in a year of gloom is the remarkable progress which has been made in air-conditioning installations in passenger cars. Early in the summer of 1930 the Baltimore & Ohio placed in service its air-conditioned diner "Martha Washington" which, with the exception of the experimental installation in a coach of the same road, marks the first practical adaptation of this rapidly developing art to railway equipment. Shortly following that event a diner equipped with air conditioning went into service on the Atchison, Topeka & Santa Fe. At the present time the B. & O. is operating 41 air-conditioned cars, and one or more cars equipped with various air-conditioning systems are in service on the Missouri-Kansas-Texas, the Chicago & North Western, the Pennsylvania, the Boston & Maine, and the Atchison, Topeka & Santa Fe. The Pullman Company also has a number of cars equipped with test installations of three systems and announces its intention of having a number of sleeping cars equipped for regular service during the coming summer.

The first impression created by the term "air-conditioning" is of a hot summer day upon which one, surrounded by a delightfully cool interior atmosphere, looks out through the broad, clean window of a well-appointed passenger coach, diner or parlor car. The full significance of the term, however, is not comprised within this picture. Not only does it involve the cooling of air during the summer months and its heating during the winter, but it also includes cleaning and humidity control—in fact, it involves the control of every factor affecting the character of the atmosphere with which human beings are surrounded. The advent of air conditioning therefore implies a complete new era in ventilation which promises to effect almost as much improvement in the comfort and desirability of railroad travel as does the ability to overcome the handicap of high temperature during the summer months.

For many years ventilation of railway equipment has depended upon the suction ejector principle which produced a slight vacuum within the car and depended for effectiveness on the infiltration of highly dust-laden air around windows and doors. Dirt in disagreeable quantities has thus always been the price of air changes in the interior. Most of the air-conditioning systems which so far have been installed reverse this action and control the ventilation at the intake. This permits filtering and, by slightly raising the pressure of the interior, allows the air to filter outward around the windows and doors and through any other openings which may be available. A means is thus provided for the elimination of the dirt nuisance which is present all the year around, as well as for cooling in the summer and a better distribution of heat in the winter.

While summer cooling is far the most striking effect of air conditioning, it is questionable whether the elimination of the dirt nuisance, both summer and winter, may not prove to be equally effective in lifting railroad travel to the highly attractive diversion which travel advertising would have it appear.

One of the disturbing trends with which the railroads have been confronted since 1920 is the steady decline in the volume of passenger traffic. While much of this loss has gone permanently to the privately owned automobile and a smaller portion to the bus, there is undoubtedly an opportunity for materially increasing the long-distance travel by rail if the railroads will meet the taste of a discriminating public. Luxurious appointments covered with dirt are not a harmonious combination for this purpose.

NEW BOOKS

LIFE EXPECTANCY OF PHYSICAL PROPERTY. By Edwin B. Kurtz, *E. E., Head of Department of Electrical Engineering. The State University of Iowa. Published by the Ronald Press Company, 15 East Twenty-Sixth Street, New York. 206 pages, 6 in. by 8½ in. Price $6.*

The principles and methods which have been successfully used by life insurance actuaries in dealing with the problems of human mortality have been applied to the life problems of physical properties—structures, machinery, equipment, etc.—by Mr. Kurtz, who crystallizes in his book recent advanced thinking upon the problems of depreciation and obsolescence. Engineering and accounting aspects of the problems involved have been combined and, as a result of years of research and analysis, basic laws and principles governing the mortality of physical property have been developed. Methods, based on these laws by which the life factor and the factors of replacement and renewal in a group of physical items may be determined and mortality tables and curves computed, are described in detail and illustrative data presented in tabular form. The many charts and diagrams with which the book is illustrated are fully explained in the text.

MODERN DIESEL ENGINE PRACTICE. *By Orville Adams, consulting Diesel engineer. Published by The Norman W. Henley Publishing Company, 2 West Forty-Fifth street, New York. 650 pages, 6 in. by 9 in. Illustrated. Price $*

Fundamental basic facts requisite to Diesel-engine theory and operation, as well as rules for maintenance, are found in this book written by a recognized authority and student of modern Diesel engineering and operating practice. The book, written in non-technical language and with the purpose of combining in one volume for the student and practical engineer a text for study and reference, is a practical manual on operation and repair arranged in logical order and covering in its 20 chapters all types of Diesel engines, their operating principles and applications, methods of installation, operating costs, etc., based on the experience of leading Diesel-engine manufacturers, engineers and experts on servicing and operation. It contains a review of Diesel history, as well as complete analyses and discussions of high-speed, mobile applications, such as locomotive and rail-car engines. Special reference is made to marine applications, and the field of light-weight aircraft and automotive type engines is discussed.

THE READER'S PAGE

Checking Braking Force

To THE EDITOR:

In the September issue appears an interesting article entitled "Checking Braking Force on Cars," together with the brake-rigging diagram.

The force in the brake cylinder is taken as 3,925 lb., and the lettering of the diagram would lead one to believe that the same force is necessary in the hand-brake rod, while the dimensions would indicate the hand-brake rod force to be 3,600 lb. Due consideration of hand-brake requirements is of importance, especially under conditions of maximum loading.

A SUBSCRIBER.

Wanted—Standard Limits For Brake-Head Renewals

To THE EDITOR:

Within the past few months everyone is getting hot on replacing brake beams on all classes of cars for worn-out brake heads. In the rules of interchange one type of beam is mentioned and only one condemning limit is specified. This will be found on page 88, Rule 63, fifth paragraph.

A worn-out brake head is not only dangerous but also costly to the owner of the car, because if the shoe cannot hang in true alinement with the wheel it not only will wear out more shoes but will also wear the wheel irregularly. So it is cheaper to remove the beam at the proper wear point than to continue to replace broken and worn-out shoes.

Some roads have set a standard to remove beams worn 2⅛-in. or more in the key way or with any top or bottom guide broken or worn out. This, I believe, is a safe practice. But why not set a standard for the inspectors and repair men to follow?

TOM DEMOND.

Setting Walschaert Gear—An Answer

To THE EDITOR:

I read in the August issue an inquiry by Arthur E. Mylin relative to squaring the Walschaert valve gear. On looking over his specific example, I note that he gives the port openings both hooked up in the average running position and also in full gear.

I believe Mr. Mylin is puzzled because it would be impossible to make changes that would square the valve travel in full gear and in the short cut-off as well. This is due to inherent defects in the outside-radial valve gear which cannot be avoided. To one accustomed to dealing with Stephenson link motion, which is not subject to these distortions, the results of running an engine over in full gear after it has been squared hooked up are quite startling. Sometimes apparent errors of ¼ in. or more in the length of the valve stem and eccentric rod appear, although the engine shows square in the working notch. The Baker valve gear shows greater apparent errors than the Walschaert gear when checked in this manner. In either gear the back motion has the greatest distortion, as the gear is designed to favor the forward motion at the expense of the back motion, except in switch engines.

The full-gear port openings in the example considered may be disregarded and the figuring done from those secured hooked up in the working notch. The example, as indicated in Fig. 1 of the sketch, should be marked to show which end is toward the front of the engine.

Referring to Fig. 1, we proceed in the usual way to find the average valve-rod error. The error is 1/32 in.

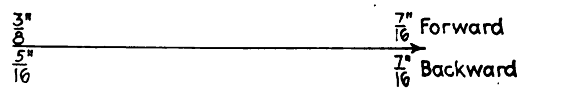


Fig.1.

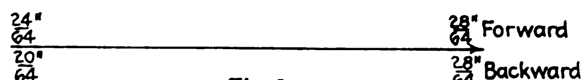


Fig.2.

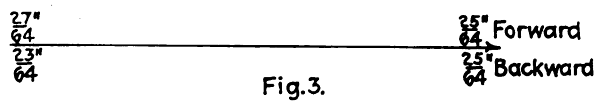


Fig.3.

in forward motion and 1/16 in. in backward motion—both out in the same direction—so add, and divide the sum by 2. Lengthen the valve rod 3/64 in.

This change would affect the example as shown in Fig. 2, in reducing to sixty-fourths. We finally complete the effect of lengthening the valve rod, as shown in Fig. 3.

Now both motions are out 1/32 in. Thus, by inspection, an eccentric rod of 1/64 in. multiplied by the ratio of the gear will square the gear setting as shown in the example. Assume the ratio of the gear to be 8 to 1 in this reverse-lever position. Therefore shorten the eccentric rod ⅛ in.

A READER.

Why Use Taper Bolts In the Eccentric Crank?

To THE EDITOR:

In connection with the report of the A.R.A. Committee on Eccentric Cranks on page 354 of the July issue of the *Railway Mechanical Engineer,* the question of the recommended practice of securing the eccentric-rod pin in the crank does not appear to have been discussed. This fit bearing is necessarily very short, not 3 in. in many instances, and reduced ¼ in. for the rivet countersink. Also, the wall of metal on three sides of this pin is 1 in. It would seem to me that there must be one best method of applying this. Should this method not be described?

Should design, Fig. 6, be adopted, what pressure does the committee recommend? Would this not be an ideal place for the use of the age-old method of shrinking? I believe much can be said against pressing these pins in and in favor of shrinking them. What has been

found the proper allowance for fit on a pin 3 in. in diameter, 2¾ in. in length, with a wall as described above?

Personally, I am strongly for the design shown in Fig. 7. While we are reviewing this report, what clamping effect will tightening the nuts on the two tapered bolts that have been fitted and driven into these holes have on the crank pin? If it is the intention, and I believe it is, that these bolts have a nipping effect on the slotted crank arm, why should they be a drive fit in the holes? Rather, should they not be two or three thousandths slack? Cutting the ⅜-in. slot and then driving home the bolts seems to me to defeat the very purpose of cutting the slot.

VALVESETTER.

Know Your Chill-Worn Wheels

TO THE EDITOR:

I note from a letter to the editor, which appeared in the April, 1931, issue that some car inspectors do not know a worn-through chill wheel when they see one. Let me also state that there are some foremen who do not known a worn-through chill wheel when they see one. One of them used a tread-worn-hollow gage on a wheel and, because it would not take the gage, the wheels were not taken out. It had about a 6-in. spot not exactly flat, but considerably out of round. The oil-box lid was broken off and the hinge portion shone like a new silver dollar. There was every evidence of a chill-worn spot. That such was the fact can be proven by two inspectors. It was evident that these men knew more about wheels than the man who allowed the wheels to run after the car was on his repair track.

A READER.

Articulated Locomotives And Museum Mis-Statements

TO THE EDITOR:

In your June number I note another reference to "Mallet simple articulated locomotives". Possibly the editorial opinion in regard to the designation of these locomotives had undergone another change since the publication of Mr. Augur's "historical" letter in your columns some two years ago.

If the dimensions given on page 344 of your June number are correctly quoted, then the model of Stephenson's Rocket referred to is not an actual size replica. The wheelbase of the Rocket was 7 ft. 2 in. so that the engine could not have been only 7½ ft. long. As a matter of fact, the overall length of engine and tender was in the neighborhood of 21 ft., instead of only 11½ ft. as stated.

The Rocket certainly proved the suitability of the steam locomotive for handling passenger and general freight traffic at the speeds required on public railways, and established a basis for sound future development. But no person with any knowledge of early locomotive history would ever contend that this was the world's first successful locomotive. Probably that is just another of the bombastic mis-statements with which museum exhibits are often labeled.

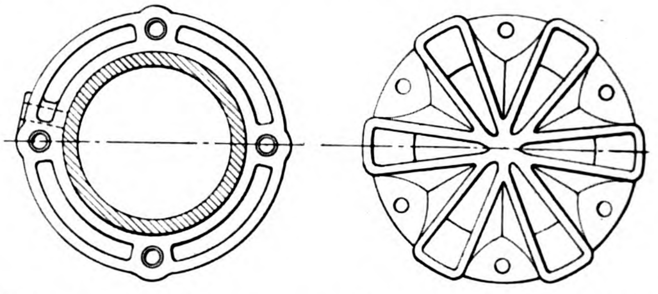
WM. T. HOECHER.

Naming The Child

TO THE EDITOR:

In the September, 1930, issue of the *Railway Mechanical Engineer,* page 499, there appeared an interesting article on improving draft efficiency and reducing back pressure of locomotives, by George W. Armstrong.

In this article, as well as in some recent railway reports of locomotive tests, the name "annular ported" is applied to modifications of the Sweney nozzle. This



Left: Annular exhaust nozzle—Right: Radial-ported nozzle

nomenclature, it seems to me, is misleading and a technical error. The true annular nozzle, and correctly known as such, has a circumferential exhaust opening, usually around an inner circular opening, such as the type of nozzle which has been used for 30 years on articulated and cross-compound locomotives. Modifications of the compound annual nozzle suitable for single-expansion engines have from time to time been applied.

This so-called annular ported type of nozzle will doubtless come into more or less common use due to its already proved efficiency, and I believe that an effort should be made to correct the misnomer which has found its way into print and that the type should be called by a name consistent with its design. My suggestion would be "radial ported nozzle."

HARRY S. BURNHAM.

[Although the ports are disposed annularly about a closed center in the modified Sweney nozzle, the term "radial ported" probably describes the nozzle better than any simple designation which can be applied to it.—EDITOR.]

* * *

A group of Baltimore & Ohio car-department employees at St. George, Staten Island, N. Y.—After the photograph was taken, the prevalence of goggles was noticed—Every man whose work required it was wearing them

With the

Car Foremen and Inspectors

Steam-Heat Failures In Passenger Service

By A General Car Foreman

WITH the first cold snap of winter it is not difficult to determine whether or not the proper preparations have been made to safeguard passenger car equipment, especially those parts which are used for the heating of the cars, against failures and the resulting delays to trains as well as complaints from the traveling public.

A passenger-train delay caused by a burst steam hose can usually be attributed to one of two things: A deteriorated hose—one which is dried out, cracked or fractured and easily detectable—or to excessive steam pressure applied either at the time the hose burst or at some previous time when excessive pressure was turned into the steam train line in order to force out the condensation, at which time the inner fabric of the hose was fractured.

Delays of this nature are usually excessive because the train crews are not altogether familiar with the handling of tools and must also protect themselves from burns or scalds while changing a hose. They must also be careful not to soil their uniforms. Then too, unless steam heat hose has been removed at the beginning of the season and the threads on the nipple end of the hose have had graphite or some other non-corrosive substance applied, it is possible that some delay is going to result in removing the old hose due to corrosion in the threads.

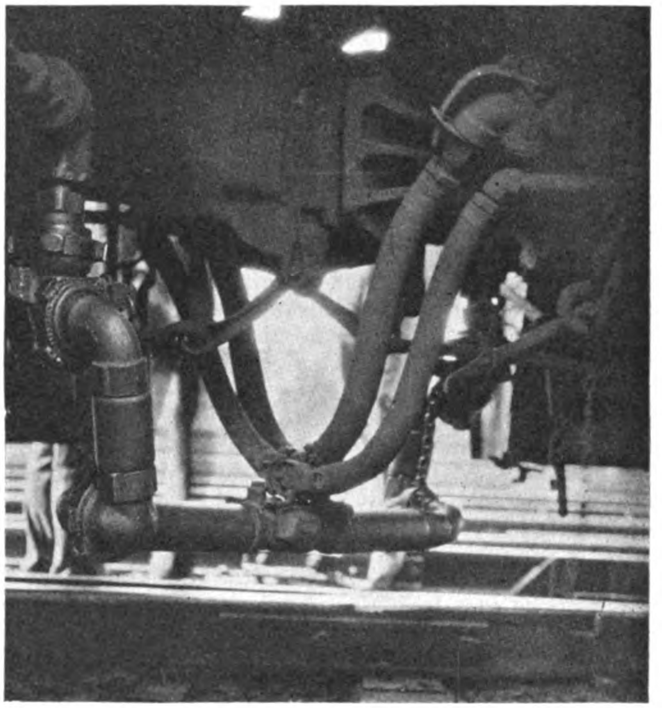
So many different types of steam hose couplings, or heads, are now in use on the various railroads that some definite arrangement should be made to standardize one head or at least those heads which can be coupled properly and which can be expected to remain together and prevent steam leaks or failures out on the line. When two different designs are found, there is a question of doubt in the mind of the car inspector or the steam heat man who must perform the work as to whether he will be censured for not correcting a minor steam leak or for failure to make a good coupling, should the hose part.

It is well known by the majority of railroad mechanical men, as well as many trainmen, that the S-4 type head, being equipped with the commonly known "hairpin lock" will not make a satisfactory coupling with the 804-S type coupling, having the wedge lock. It is true that in many cases no failures result when these two heads are coupled together, but we must admit that it is more a case of good fortune than of good management. Usually, very little difficulty is experienced in making a satisfactory coupling with the 804-S type head having the low bridge and short, straight wedge when coupled to the same type head having the high bridge and long, curved wedge.

The new or more modern type 825-S steam hose head having a much larger head than either the old types S-4 or 804-S can be coupled satisfactory with the 804-S head which has the high bridge and long, curved wedge, but cannot be coupled under any circumstances with the old S-4 type head or the type 804-S head having the low bridge and short, straight wedge unless an auxiliary lock, in the form of a tapered wooden pin or a ⅝-in. steel pin or bolt is driven through the eye of one of the couplings to insure against the heads parting should the wedge be displaced. When a wooden pin is used for this purpose it can be broken out with little difficulty when the hose are uncoupled at a terminal for either switching purposes or for changing engines. However removing the steel pin or bolt is sometimes a more difficult task and many times results in employing the aid of a chisel with an ensuing delay to the train.

End Train-Line Steam Valves

Among the various types of end train-line steam valves the type which is equipped with the universal-joint handle and which is in the open position when the indicator on the valve stem points downward is considered most efficient. These valves are usually equipped with a type of handle having a weight balance which neither vibration nor steam pressure can move, thus preventing the valve from closing while the car is in transit.



Metallic steam-heat connections are fast supplanting the conventional steam hose

Unfortunately, many kinds of steam valves are being used, especially on baggage and express cars and cars of the older classes. It is not uncommon to find ordinary globe valves, with or without extension handles leading to the outside of the car for operation, being used on

this passenger train equipment. It is usually found that these older classes or types of valves are used on baggage and express cars or cars ordinarily used on local passenger trains. The baggage and express cars are ordinarily located between the engine and the passenger-carrying cars of the train. Loose valve stems, brought about by dried or worn-out packing, cause these valves to work closed and cut off the steam pressure from the remainder of the train. The results of this performance during extremely cold weather will cause the steam remaining in the train line and traps to condense and freeze very quickly, especially at the rear end of the train, and resultant delays in thawing out the line will prevail.

There have been some cases where inexperienced train porters or passengers have inadvertently shut off the steam valves by operating the steam-valve rod located on the platform in the vestibule. These cases, however, are few and can easily be determined by a close inspection of the steam valve which, if tight in the stem, will not work closed. Still other cases have been found where the indicator on the vestibule floor is shown in reverse position, indicating that the valve is in open position when as a matter of fact it is closed.

Steam Traps and Regulators

The principle of steam traps and regulators is based on the contraction and expansion of a brass diaphragm, located in the bottom of the steam trap. This is partially filled with an expansive fluid and is hermetically sealed to prevent escape. Frequently these diaphragms in steam traps do not function properly because of incorrect adjustment. They must be adjusted by means of a set screw under the steam trap. Improper adjustment will not permit the condensation to pass from the steam line and during severely cold weather it will freeze.

The method of adjusting this diaphragm is to loosen the lock nut, back out the set screw until steam blows freely through the trap. Then tighten up on the set screw until the steam is shut off and reset the lock nut. The diaphragm is expanded from the heat of the steam and just as soon as condensation takes place in the line water will gather around the diaphragm, cooling it sufficiently to cause contraction, thereby emitting the water.

The adjustment of steam-trap diaphragms should be made at the terminal before the train is dispatched and it should not be necessary to make any further adjustment at intermediate stations through which the train passes.

Thermostatic Steam-Heat Control

Passenger cars built new during the past few years as well as many rebuilt cars have been equipped with thermostatic temperature control. Various systems of thermostatic control are now being used. However, the most commonly used system is that which permits a temperature of from 70 to 75 deg. F. in the car while the car is in service. Air pressure from the brake pipe operates a selector switch and controls the temperature. When the car is detached from the train and is lying idle in the yards with the air released, the selector switch automatically goes into service and regulates the temperature of the car to 50 deg. F., preventing the pipes in the car from freezing.

There are times in service when the temperature inside the car may fall below what the train crew or passengers may consider comfortable, especially during extremely cold weather, and in these cases it is possible to cut out the thermostatic-control system and open the steam-heat valves usually found in the center of the car and provide the full steam-line pressure through the radiator pipes. It is not necessary to do this often.

Metallic Steam Heat Connections

When it is taken into consideration that failures resulting from excessive steam pressure will be entirely overcome and that it will be possible to apply steam pressure in the amount required to force condensation from trains at terminals or in yards without the liability of damage to steam-heat connections, it can be realized that much quicker train handling will be effected when metallic steam-heat connections have come into general use.

When forcing the steam through a train of from 18 to 20 passenger cars equipped with rubber steam-heat hose it is frequently necessary to uncouple from two to five hose in order to allow the cold water to be forced out without applying steam pressure from the locomotive in excess of 90 lb. Pressures in excess of that amount are likely to injure the rubber hose, causing either an interior fracture in the fabric or causing it to burst. With metallic connections it is possible to turn sufficient pressure into the steam train line to force the condensation through the entire train without the necessity of uncoupling steam heat connections.

Annual Inspection and Maintenance of Steam-Heat Equipment

In advance of the approach of the winter season a careful inspection should be made of all steam-heat equipment and the necessary repairs made to condition it for service. At this time steam-heat hose should be removed, examined and tested under pressure to insure against failures. Before applying the hose a non-corrosive preparation should be applied to the threads on the nipple end where it screws into the steam valve so that it can easily be removed should the occasion present itself while in passenger service. A metal tag bearing the date and station where this work was done should be attached to the steam-valve stem to eliminate duplication of the work.

At this time the packing nut should be removed from the end train-line valve and new packing applied. The packing nut should then be tightened sufficiently to allow the stem to turn under ordinary pressure from the valve rod or sufficient to prevent it from working closed due to vibration.

All pipe clamps should be examined to see that they are holding the steam pipes in position and that the pipes are not worn where they have come in contact with the pipe-clamp brackets or the underframe of the car. In many cases it is found that, after steam pressure has been applied to the train steam line, especially on cars that have not had steam heat through them for several months, the pipes have corroded and require renewal.

Where metallic steam-heat connections are used, they should be removed and tested. Usually the gaskets in the metallic connections require renewal only once each season. They should be renewed at this time to eliminate steam leaks and failures which may result during severe weather.

Diaphragms in steam traps should be removed and examined to determine whether or not the expansive fluid is still intact and where empty diaphragms are found they should be renewed. After applying the diaphragm they should be adjusted and the lock nut securely tightened so that further adjustment will not be necessary.

Where thermostatic heat control systems are em-

ployed a careful inspection should be made by a competent electrician or steam-heat expert to assure that all parts are in serviceable condition. The steam-heat valves located in the interior of the car should be carefully inspected and repacked where necessary to assure that they are sufficiently tight to prevent them closing by vibration and to prevent steam leaks.

After a thorough inspection of all of the steam-heat appurtenances and those found defective have been repaired, a certificate of inspection should be signed by the party making the final inspection and attached to the car in a designated place, usually in the electric locker inside of the car. It should not be necessary to subject the car to another inspection of steam-heat equipment during the winter season, except of course those parts which require daily inspection, such as steam hose, steam valves and traps.

Terminal Inspections

Trains should not be dispatched from a terminal until the car inspector is absolutely sure that the steam heat is through the entire train. This is sometimes difficult to determine, especially where steam heat is coupled to the rear of trains in stations while engines are being changed. After the out-going engine is coupled to the train the steam connection at the rear is usually disconnected, then the steam heat is turned in from the engine. When the steam valve on the rear car is opened the pressure that remains in the car may deceive the inspector and indicate to him that the steam is through the train from the engine. This may not be the case, however, and there may be a steam valve in the body of the train that is either partly or entirely closed. Inspectors should see that there is a sustained volume of steam from the rear valve before allowing the train to depart.

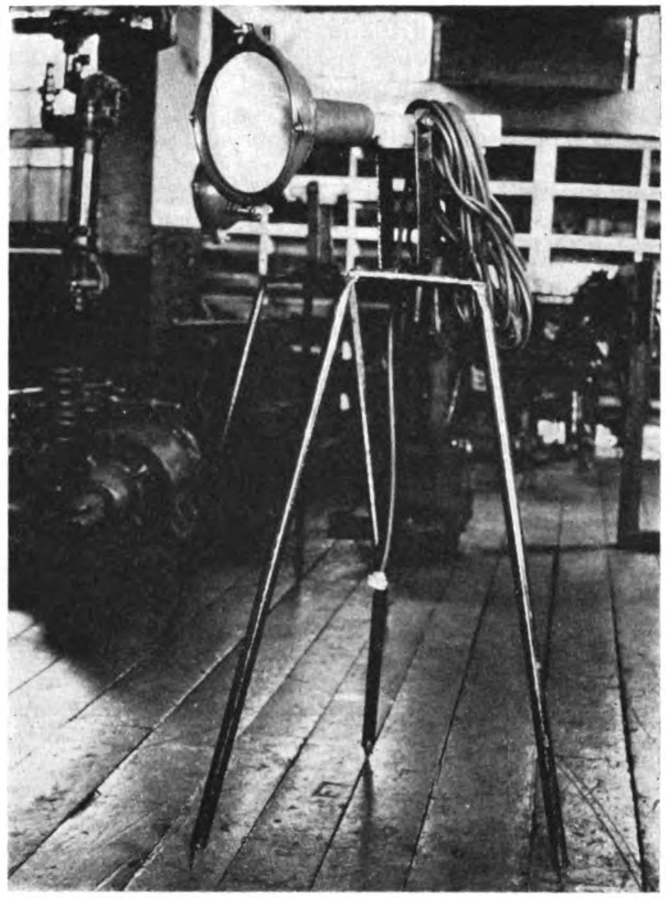
When making inspections of through trains at intermediate terminals car inspectors should observe the position of the steam train-line valves to see that they have not worked either wholly or partially closed due to vibration or contact. In the event it is found that the valves are loose at the stem and sufficient time is not available for repacking, it should be wired in the open position, the train crew notified and the final destination of the car notified to make permanent repairs.

Portable Electric Lights For Repair Tracks

IN train yards and on car repair tracks which have been set aside for repairs to cars set out of fast-freight trains it is practically impossible to arrange the lighting facilities in such a manner as to afford sufficient light for workmen on the night shifts. In many instances extension cords are used by the men, but at their best they are not satisfactory.

The portable electric light shown in the illustration can be used effectively for this purpose and can also be used for emergency jobs about the shop or enginehouse. While it can be made adjustable by the use of different size pipe in the legs, this is not essential for the reason that the tension bracket which holds the reflector can be adjusted to any angle desired.

The base is 4 ft. 6 in. high and is made from one-inch pipe which is welded or riveted to a 1/4-in. plate cut in triangular form and measuring 12 in. on a side. The bracket is 2 in. wide and 1/4 in. thick and is secured to the base plate by one 5/8-in bolt equipped with a wing



A light of this type can be used for many purposes around the shop

nut which permits the movement of the bracket. The size of the reflector can be either 12 in. or 18 in. as desired. It is secured to the top of the bracket by one 5/8-in. bolt which is also equipped with a wing nut to permit adjustment.

The length of the extension cord is governed by the location of electric-light receptacles. A 75-ft. cord is best suited for use on car repair tracks so as to enable the repairmen to move the light to any position that will require better lighting without necessitating changing the plug at the receptacle.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Head of Tank Car Burst—Handling Line Responsible

Union Tank Line car No. 4602, loaded with furnace oil, was shipped from River Rouge, Mich., January 11, 1929, to Detroit, Mich., via the Michigan Central and Grand Trunk Western. While this car was being switched in the Michigan Central yards at River Rouge on the date mentioned, the tank head at the Bend of the car was broken and distorted. The fracture

in the head extended 102 in. in length and opened outward. The car owner requested a defect card for damage, but the card was declined. According to the statement of the car owner, which was supplemented by a number of exhibits of material tests and statements from the yard crew, it was contended that no rider protection was furnished and that the speed of the car was undoubtedly greater than that given in the statement made by the handling line. An analysis of the steel in the head of the tank car showed that the material complied with A. S. T. M. specifications. The section of the tank head removed did not show any evidence of distress other than the fracture which the car owner claimed could have only been caused by rough handling. The railroad in its statement also submitted a number of exhibits showing the conditions involved in the handling of this car at the time of its failure. According to this statement the car was cut from the train while the train was standing still and only moved a distance of six or seven car lengths at an estimated speed of two miles an hour. The tank head burst at the time the car struck a second Union Tank Line car which was standing on a lead track. The railroad's statement showed that, with the exception of the fracture, no seams or rivets showed indications of distress and contended that the fracture was undoubtedly due to an existing weakness of the material in the plate caused by the bend in the flange.

The Arbitration Committee decided that: "No evidence is presented to indicate that the metal in the damaged tank head was less than the required thickness or that the indentation due to contact with the former head-block anchored was 1½ in. or more, or that any defect existed in the material. Neither does the evidence presented indicate improper workmanship. Therefore, the handling line is responsible for the failure under third paragraph of Rule 32."—*Case No. 1673, Union Tank Car Company vs. Michigan Central.*

Owner Responsible for Coupler and Yoke Pulled Out of Tank Car

SKYX car No. 2017 was damaged at Garyville, La., on March 12, 1929, while on the lines of the Illinois Central. The car was sent home to the Skelly Oil Company for repairs, because the railroad was unable to repair the car. The Illinois Central claimed that the damage was sustained by making an ordinary stop of the train when the coupler on the tank car dropped out, causing the damage. A joint inspection report by two inspectors of the North American Tank Car Company and the St. Louis-San Francisco, respectively, indicated unfair usage. The Skelly Oil Company requested a defect card from the railroad, which was refused. In its statement the railroad pointed out that the inspectors' report of the accident did not show that the car or any other cars in the train had been derailed or subject to any other condition under Rule 32. For that reason the condition of the car was considered to be the owner's responsibility and the car was moved to its Baton Rouge, La., shops, where the coupler was replaced and a new yoke applied. In addition, some temporary repairs were made to place the car in condition for safe movement to the owner's shop. The railroad claimed that although it was able to make repairs to the car, it was not its practice to do so when the condition of the car was due to the owner's responsibility and if the repairs would exceed light repairs. This has been the practice of the railroad because tank-car owners usually wish to make their own repairs in their own shops. The Skelly Oil Company in its statement claimed that the amount of damage sustained by the car while making an ordinary stop of the train was so extensive that it indicated more than ordinary handling. Furthermore, the joint inspection report showed that the car had received rough handling. The car was routed home over the Missouri & North Arkansas and the Atchison, Topeka & Santa Fe. Both of these railroads advised the car owner that the car had been subject to no repairs or rough handling while on their lines. The car owner requested a repair card, in addition to the items already covered by the railroad's repair cards, which included pipe line repairs, application of coupler yoke, two new yoke rivets, and temporary repairs consisting of sill straightening and two short side sills and one metal striking plate straightened and repaired, a repair card covering the application of a wrong running board and showing the nature of the damage to the running board removed. As further evidence the car owner submitted a repair bill from the North American Car Corporation covering labor and material for repairing the damage, the extent of which was considerably more than that reported by the railroad. It was contended that the Illinois Central had not furnished sufficient evidence to sustain its statement that the car was damaged while subject to fair handling.

The Arbitration Committee in rendering its decision stated: "There is no evidence of unfair usage within the intent of Rule 32. The contention of the Illinois Central is sustained."—*Case No. 1674, Illinois Central vs. Skelly Oil Company.*

Delivering Line Furnishes Insufficient Information on Damage

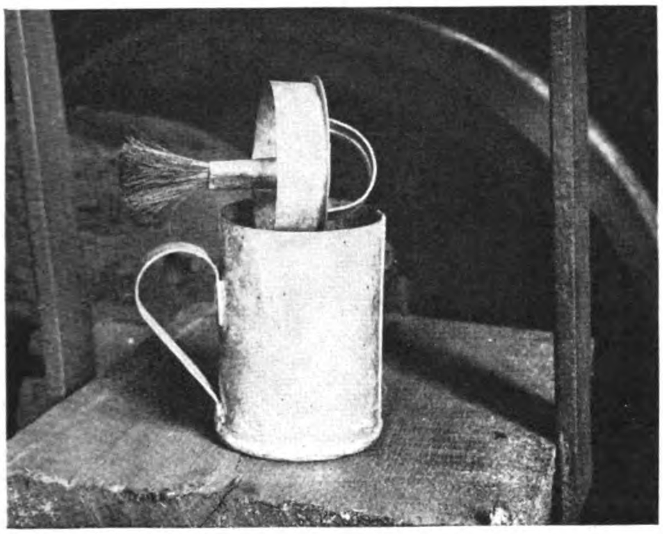
The St. Louis-San Francisco reported on April 4, 1929, that E. S. L. J. car No. 5007 was held at Birmingham, Ala., according to Rule 120, because of damages incurred in its East Thomas yard, stating that a switch engine moved six cars onto a track and coupled to about 38 cars at a speed between three and five miles per hour; and that, as the locomotive started to push the train, the E. S. L. J. car No. 5007, which was the fifteenth car from the locomotive, buckled in the center, breaking two side sills, two intermediate sills, two draft sills, and two center sills. The car was not derailed and was moved to the repair track for disposition. In their reports the members of the crew indicated that none of them was aware that the car was damaged at the time, which was early in the morning, but it was found on the same track in the damaged condition by the chief inspector a short time later, no other engine having been on the track during the interval. The Mather Stock Car Company contended that the statement furnished by the railroad to comply with Rule 44 did not, therefore, convey in sufficient detail the circumstances which surrounded the failure of the car. On May 13, 1929, the car owner requested from the handling line copies of all accident reports, etc., for the purpose of making disposition of the car without the expense of a trip to Birmingham. It also requested that, if possible, the railroad arrange to hold the car for inspection and investigation at that point. The railroad apparently ignored this request and advised on May 28 that the car had been dismantled. Copies of accident reports were not furnished as requested and during a special investigation, which was

held on June 12, 1929, with a representative of the car owner present, the car foreman advised that the car had been on the repair track for a few days prior to the alleged accident and that it was being switched off on the night of March 24. The available repair track and interchange records failed to show that the car had been on the repair track and showed that the Frisco held no record of the defects on the car either in interchange or at the terminal prior to the time it was found in the damaged condition on the repair track after the alleged accident. On the basis of these findings and of an agreement to exclude any evidence which might have been furnished by certain members of the crew, who were not available for examination during the special investigation, the car owner maintained that the handling line had failed to substantiate its contention that it had complied with the requirements of Rule 44 in reporting the car to the owner under Rule 120.

In rendering its decision the Arbitration Committee stated: "The handling line has not furnished sufficient information to substantiate its contentions that the combination of damage to this car occurred in fair usage. Handling line is responsible."—*Case No. 1675, St. Louis-San Francisco vs. Mather Stock Car Company.*

Can for Oiling Journal Bearings

BEFORE applying a journal bearing to the wheel journal a coating of clean oil should be applied to the bearing in order to prevent friction between the brass and the journal before the oil in the packing has had a chance to coat the journal. Many hot boxes re-



This small can with a brush in the cover keeps the dirt out of the oil

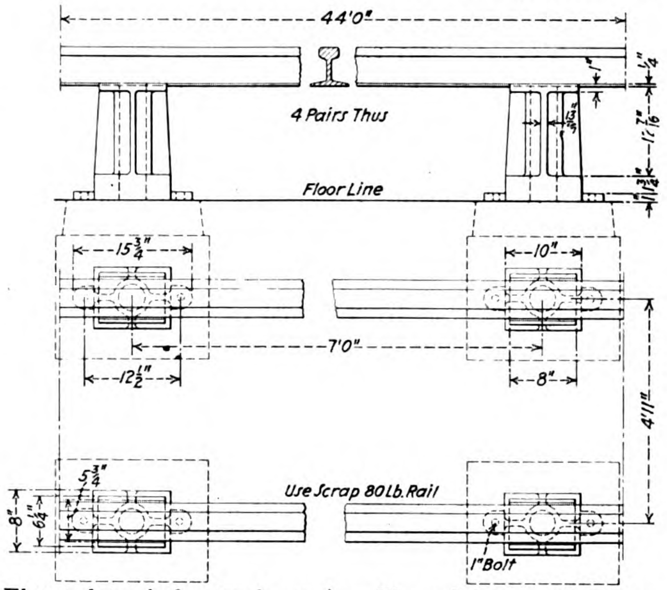
sult from particles of waste or grit being mixed with the oil due to the careless methods used in handling this oil at the time it is used by the workman.

By the use of a can, equipped with a metal cover to which a brush is attached this condition can be entirely eliminated. The can should be filled with clean oil each day and when wheels are applied the oil can be brushed on the bearing instead of being poured. This not only will result in a saving of oil but will insure the bearing being fully covered. Should any oil be left in the can at the close of the day it can be sent to the oil reclamation plant, and the can thoroughly cleaned and refilled for use the following day.

The size of these cans depends on the amount of work performed. For the ordinary light car-repair force which is engaged in applying wheels and other repairs work a small can is suitable; for heavy repair shops or where a force is assigned to the building or re-building of trucks exclusively a larger can (½ gal.) should be used.

Elevated Track For Truck Repairs

SHOWN in the drawing is a design of elevated track which is used in the car and locomotive shops of one railroad. It is constructed of 80-lb. scrap rail which rests on cast-iron pedestals. The pedestals are



Elevated track for truck repairs—The rails are mounted on cast iron pedestals

spaced 7 ft. apart, center to center, and can be placed directly on a concrete floor or light concrete foundation. They are held in place by 1-in.. bolts or studs imbedded in the concrete. The height from the floor to the underside of the rail is 15$\frac{3}{16}$ in.

Questions and Answers For Air-Brake Foremen

FOLLOWING is the fourth of a group of questions and answers selected from the instruction pamphlet recently revised by an eastern railroad:

Q.—What should be noted with regard to the rate at which brake-pipe pressure reduces and brake-cylinder pressure increases when a brake-pipe reduction of 20 lb. is made? A.—The brake-pipe pressure should reduce at about the same rate as the equalizing-reservoir pressure. Brake-cylinder pressure should gradually build up to 50 lb.

Q.—What should be noted with regard to main-reservoir pressure when a brake application is being made? A.—That the main-reservoir pressure does not fall appreciably.

Q.—Explain how to determine main-reservoir and brake-cylinder leakage. A.—With the automatic brake valve in lap position, independent brake valve in running position and 50 lb. brake-cylinder pressure, close the cutout cock in the distributing-valve supply pipe, also the air compressor throttle on steam locomotives. On electric locomotives the canopy switch should be opened and the cocks in the control line and the J-7-8 master governors closed.

Q.—What should be the maximum permissible brake-cylinder and main-reservoir leakage allowed? A.—Seven pounds brake-cylinder leakage per minute from an initial pressure of 50 lb.; main-reservoir leakage not more than 3 lb. per minute for three consecutive minutes from a pressure of not less than 95 lb.

Q.—Explain how to make a brake-cylinder leakage test on engines equipped with A-1 or combined-straight air and automatic equipment. A.—Place the straight-air brake valve in application position. Lap the straight-air brake valve when 45 lb. brake-cylinder pressure is obtained and observe the drop in brake-cylinder pressure.

Q.—What is the maximum permissible amount of brake-cylinder leakage on engines equipped with combined straight air and automatic equipment? A.—Seven pounds per minute from an initial pressure of 45 lb.

Q—Explain how to make a brake-cylinder leakage test on engines not equipped with the straight-air brake valve? A.—By developing 50-lb. cylinder pressure on service application; placing the brake valve in lap position and observing the drop in brake-cylinder pressure.

Q.—What is the maximum brake-cylinder leakage allowed on engines equipped with A-1 equipment? A.—Seven pounds per minute from an initial pressure of 50 lb.

Q.—Explain how to make a brake-cylinder leakage test on the tenders of engines equipped with A-1 equipment? A.—Note that the tender brake shoes are held against the wheels with force for five minutes.

Q.—What should be done when brake-cylinder leakage exceeds 7 lb. per minute? A.—Clean the brake cylinders, and if necessary apply new packing and lubricate.

Q.—Explain how to apply brake-cylinder lubricant? A.—Only a thin film should be applied to the cylinder and cylinder bearing area of the packing.

Q.—What should be done after noting main-reservoir and brake-cylinder leakage? A.—Open the cutout cock in the distributing-valve supply pipe, also the air-compressor throttle, (on electric locomotives the cocks in the control line and J-7-8 master governors should be opened and the canopy switch closed), then place the automatic-brake valve in release position. Brakes should not release with the independent brake valve in running position, except on locomotives on which the holding feature has been eliminated. It should be noted, also, that air is discharging at the warning port of the automatic brake valve, and that the main-reservoir, equalizing-reservoir and brake-pipe pressure indicators register within three pounds of the same pressure.

Q.—What may cause equalizing-reservoir pressure to reduce too rapidly with the automatic brake valve in service position? A.—Preliminary exhaust port too large; leak from the equalizing reservoir or related piping, including the tube in the gage, or the equalizing-reservoir volume reduced.

Q.—What may cause too slow a rate of equalizing-reservoir pressure reduction with the automatic-brake valve in service position? A.—Preliminary exhaust port may be restricted, or there may be a leak into the chamber above the equalizing piston from the main reservoir or brake pipe, or lost motion in the brake-valve handle or rotary-valve key.

Q.—What may be the effect of high friction in the service parts of a triple or distributing valve? A.—May cause them to move to emergency position, which will also build up brake-cylinder pressure at emergency rate.

Q.—What is indicated if main-reservoir pressure drops during a brake application and is slowly replenished afterwards? A.—Restriction in the main-reservoir-supply pipe or a partially open main-reservoir cutout cock.

Q.—What is indicated if 50 lb. brake-cylinder pressure is not obtained with a brake-pipe reduction of 20 lb. at a service rate from an initial pressure of 70 lb.? A.—Pressure chamber or auxiliary reservoir is not fully charged; pressure chamber or auxiliary volume reduced; leak from the application chamber or cylinder, or related piping; compensating port plugged or restricted on EL double-end equipment; defective or leaking brake-cylinder high-speed reducing valve or safety valve; defective independent or automatic-brake-valve rotary valve or seat, or lower gasket of independent brake valve, defective application-piston packing leather or cup or high friction; also leaking brake cylinder or related piping, a defective brake-cylinder pressure-head gasket, packing cup or leather, or excessive piston travel with A-1 equipment.

Q.—In what time should brake-pipe pressure reduce to zero with the brake in emergency position? A.—Two or three seconds.

Q.—What else should be noted when the brake valve is in emergency position in addition to the preceding question? A.—That discharge of air from the emergency exhaust port is regular; that emergency action is obtained; that the brake-pipe vent valve functions to deplete the brake-pipe pressure; that brake-cylinder pressure rises rapidly to the setting of the high-speed reducing valve or safety valve; that the distributing-valve safety valve blows continuously; that brake-cylinder pressure maintained with EC or ET equipments is slightly higher than the setting of the distributing-valve safety valve, and that brake-cylinder pressure does not fall appreciably below the standard setting of the high-speed reducing valves or safety valves with A-1 equipment.

Q.—After proceeding as instructed in the two preceding questions what should be done? A.—Return the brake valve to lap position noting that the brake-cylinder pressure does not reduce appreciably below the standard setting of the distributing-valve safety valve except with No. 5 ET equipment which requires release to stop the safety valve blowing.

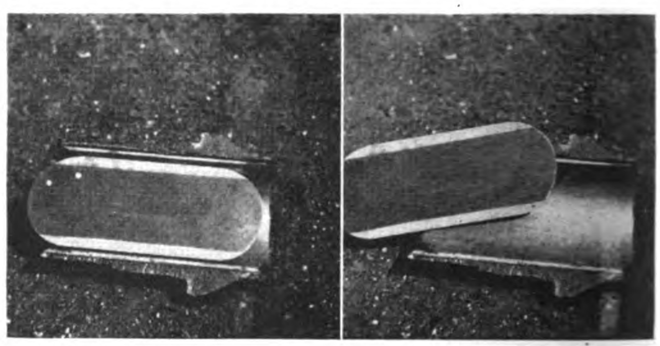
Q.—Explain how to adjust the distributing-valve safety valve? A.—Place the independent brake valve in application position; adjust the independent-brake reducing valve to maintain about 2 lb. higher pressure than the standard setting of the safety valve to be adjusted. Adjust the distributing-valve safety valve to permit a slight amount of air to escape from the vent holes in the safety-valve spring box, then reset the independent brake reducing valve to 45 lb.

Tool for Scraping Journal Bearings

Although journal bearings are ordinarily broached at the time they are manufactured they become damaged in shipping and handling, making it necessary to round out the babbitt lining and remove the burrs before they can be applied to journals.

Before applying a bearing to a journal it should be scraped and fitted to insure a proper bearing, regardless of whether it has previously been broached and has not been damaged by handling.

Any straight edge tool can be used for scraping journal bearings. However the one shown in the illustration is satisfactory for the reason that it has two straight edges and both sides of the bearing can be scraped at the same time. These scrapers can be made from discarded cold-cut saws, circular saws or tool steel, which should be ground down to a hollow ground edge. It will be found that it is seldom necessary to dress the tools if manufactured from hardened steel, as the babbitt lining in the bearings will not affect them.



Two views of the scraping tool, one indicating the manner of usin git

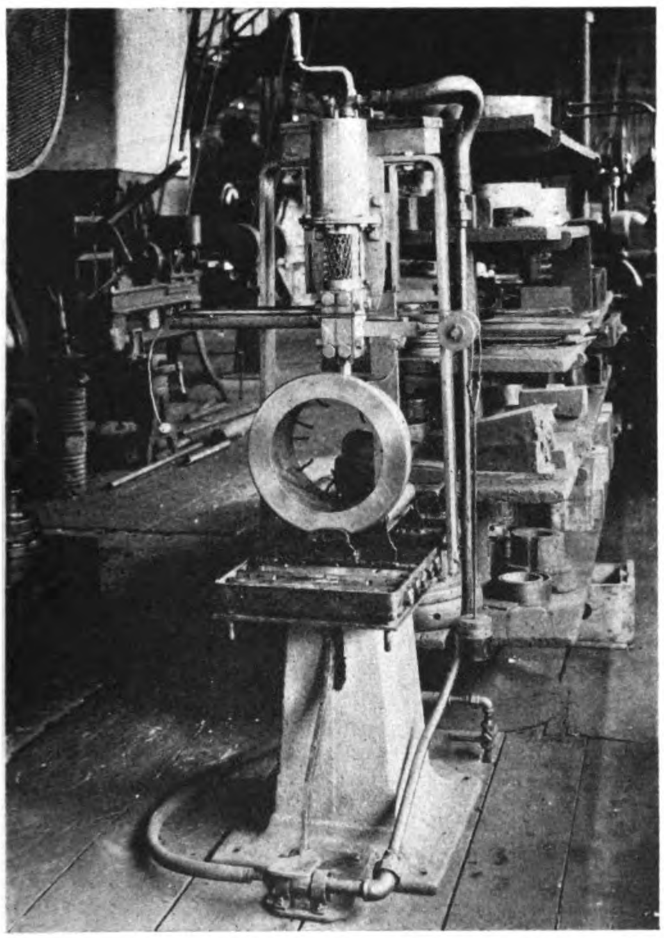
These tools should be supplied to workmen at all car-repair tracks, both passenger and freight, in enginehouses and heavy repair shops to insure a perfect fit on all journal bearings applied.

Fifty Years Ago.—During the month of March, 1881, several locomotives on the Ohio & Mississippi [now part of the Baltimore & Ohio] made some remarkable performances. Locomotive No. 109 ran 7,429 miles; No. 60, 7,275 miles, and No. 108, 7,029 miles. Seventeen other locomotives on this road made over 5,000 miles each in March. About a year ago the New York Central reported that one engine made 9,482 miles in a month.—Railway Age, May 19, 1881.

In the Back Shop and Enginehouse

Filling Grease Holes In Floating Bushings

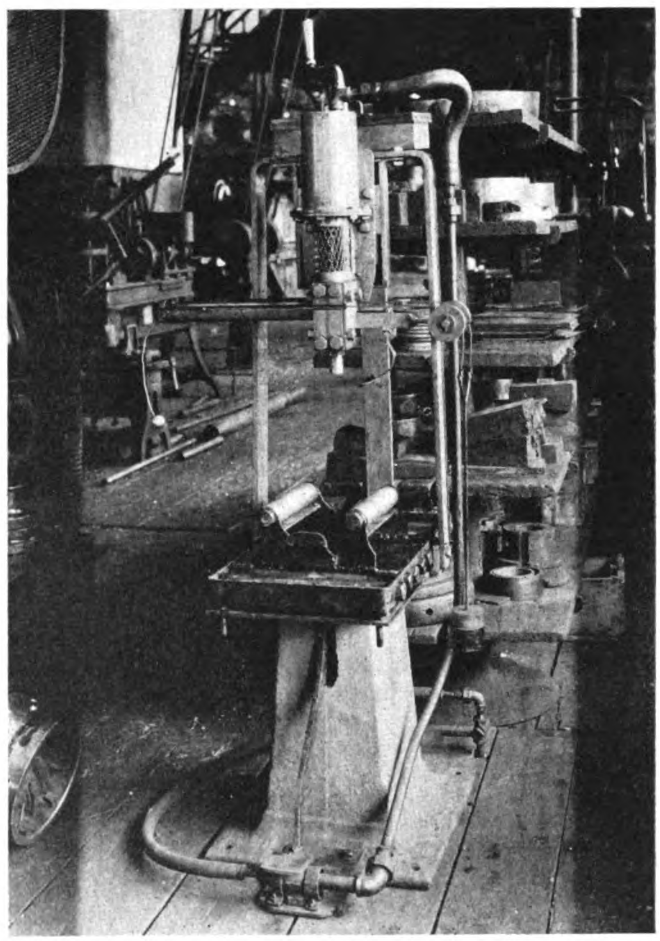
IN the Battle Creek, Mich., shops of the Grand Trunk Western may be seen a machine designed to simplify the job of filling the many grease holes of floating rod bushings before they are applied to the rods. The machine consists of a cast-iron base, on the top of which is a table on rollers. The table not only rolls back and forth across the bed of the machine but also has rollers on the top to support the floating bushings and readily permit them to revolve so as to bring the several holes under the grease nozzle.



By means of an air cylinder the grease is forced into the holes in the bushing. Grease which has been forced through is visible

The greasing mechanism consists of a vertical air cylinder having a 3½-in. bore and about a 6-in. stroke. A piston with leather packing actuates a plunger at its lower end which moves in a 1¾ in. diam. plunger chamber into which the grease is fed through a horizontal trough. Grease cakes 1½ in. diam. by 10 in. long are laid in the trough and a feeder operated by cable and weight automatically feeds the grease into the plunger chamber. An air valve controlled by a foot pedal admits air to the cylinder and operates the plunger which in turn forces grease out through a ⅜ in. nozzle into the holes in the bushing. A coil spring returns the piston to the upper position.

The cylinder and operating mechanism are supported by a bar iron frame and the cylinder itself is mounted on a sliding plate support in such a manner that it may be raised or lowered by means of a vertical to accommodate bushings of different diameters. The foot pedal not only operates the air valve but is so arranged that when it is pressed down it raises the entire table on which the floating bushing is supported. This brings the bushing up into close contact with the grease nozzle and assures the grease filling the hole. A set screw adjustment makes it possible to raise or lower the table for each size of bushing.

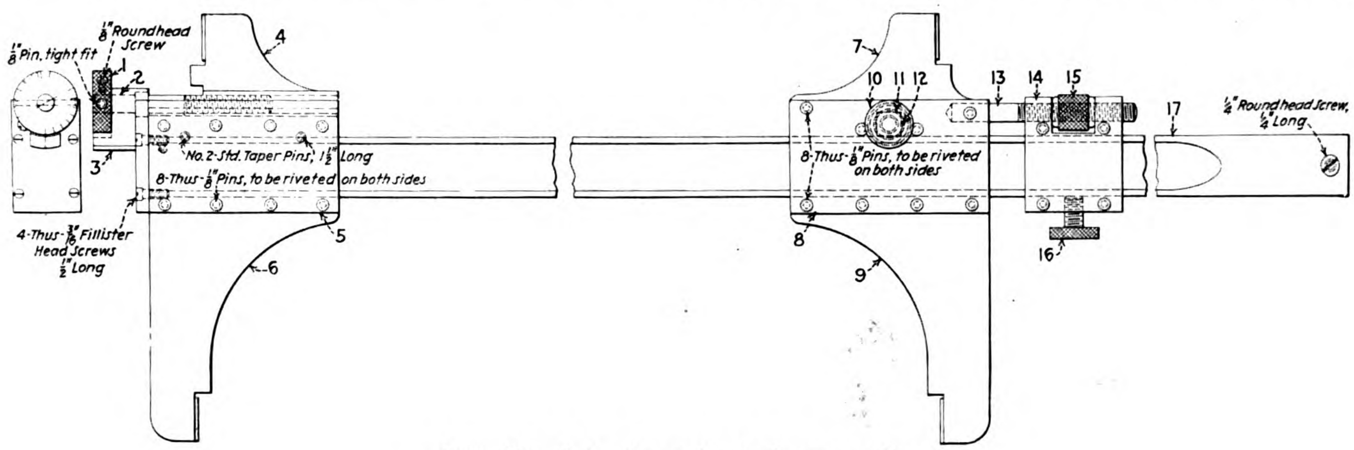


The grease machine without a bushing in place on the table

A Royal Shop.—Considerable privacy surrounds all operations connected with the railway equipment used by the royal family of Japan. The Emperor not only has a private train, but also a private shop where the locomotives and cars for the private trains of the Imperial household are kept and repaired.

Tire and Wheel-Center Caliper

Shown in the two drawings are the assembly and details of a caliper for measuring the outside diameter of the wheel center and the inside diameter of the tire to be applied. All of the parts are made

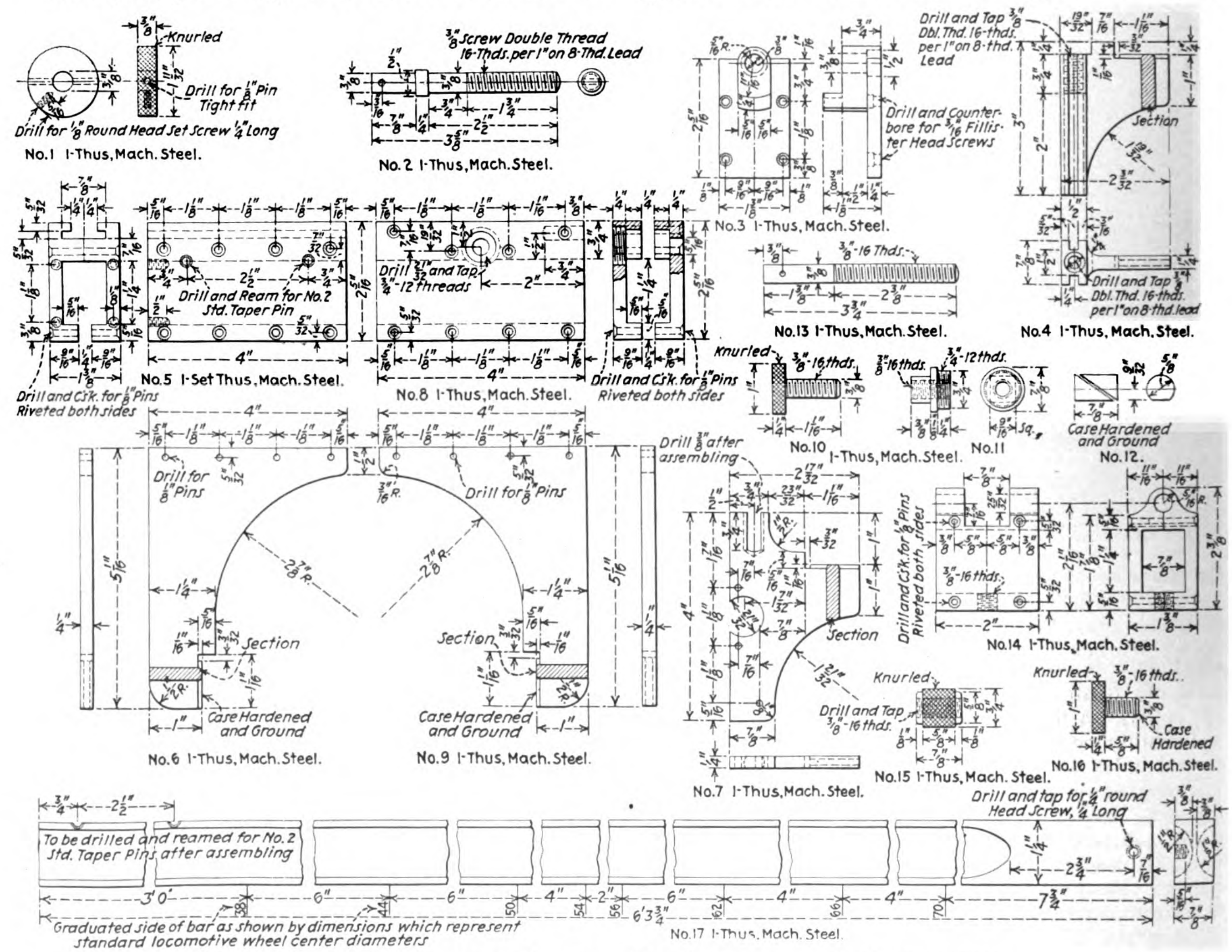


Assembly of the tire and wheel-center caliper

of machine steel. The slide bar, part No. 17, is marked on the graduated side with dimensions for the different standard sizes of locomotive wheel-center diameters.

The adjusting screw, part No. 1, is also marked for the different sizes of locomotive driving wheels. Following are the instructions for laying off the divisions on the head of the adjusting screw which is used to adjust the caliper for the correct shrinkage of tires for the different sizes of wheel centers:

Adjust the wheel-center or outside-caliper points to 12 in. Then by turning the adjusting screw on the fixed end of the caliper, adjust the tire or inside-caliper points to 12 in. Scribe a light line across the end of the screw above, on or below the center. Drill for a 1/8-in. pin at the position shown. Reassemble the caliper and set again at 12 in. Make a mark on the head of the ad-



Details of the tire and wheel-center caliper for use when shrinking on tires

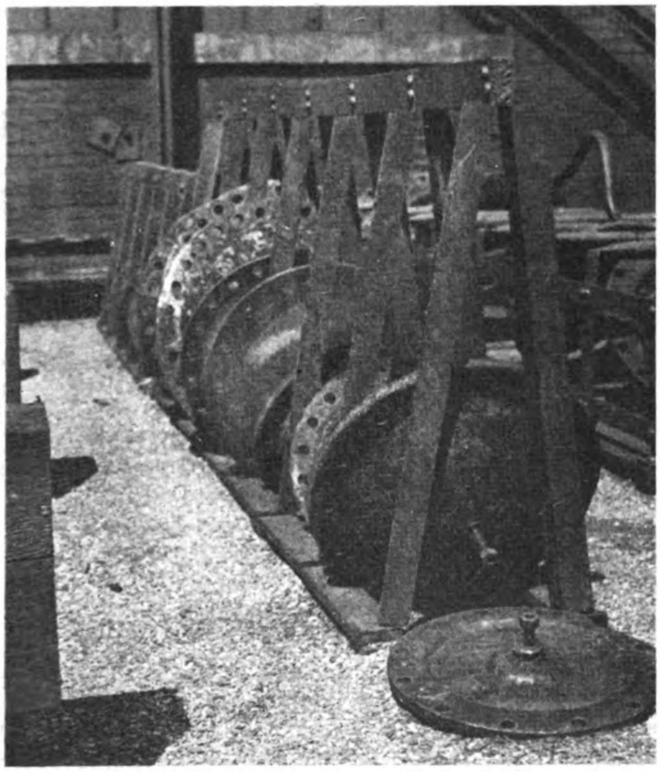
justing screw with a sharp chisel to line up with the stationary indicating mark on the adjusting-screw bracket, part No. 3. Drill and tap the hole for a 1/8-in. round-head screw at the location shown. Make one complete turn of the head of the adjusting screw to the left so that the mark on the head coincides with the mark on the bracket. The tire or inside-caliper points should measure 11 7/8 in. with the wheel-center or outside-caliper points set at 12 in. The 1/8-in. round-head screw may now be screwed into the hole provided.

Cut out the diagram which has been laid off according to the preceding instructions and glue it to the head of the adjusting screw with the mark 90 coinciding with the chisel mark on the adjusting-screw bracket. Lay off the remaining lines required according to the locations indicated by the diagram with a sharp chisel. Remove the diagram and stencil the wheel-center diameters at each line on the head of the adjusting screw.

Storage Rack For Cylinder Heads

When cylinder heads are removed from the locomotive at the back shop they should be carefully examined for defects and stored in condition for re-application at a location adjacent to where the work will eventually be performed.

A storage rack similar to the one shown in the photograph not only presents a neat and orderly appearance,

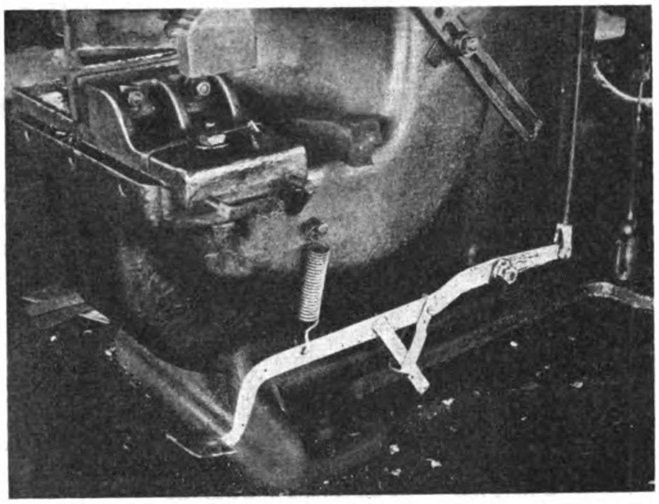


Scrap angle and bar iron were used to build this handy rack

but also will materially assist in preventing delays in looking for the proper heads. There is also a better opportunity for inspecting the heads after they are placed in the rack. The rack is constructed of three pieces of 1 1/2 in. by 4 in. by 12 ft. bar iron, two pieces of which form the bottom support and platform for the cylinder heads.

Two Shop Safety Devices

The two shop devices illustrated are designed to contribute either to safety or economy in shop practice, or both. The punch-and-shear safety locking device consists simply of a steel strap or bar bolted to the operating foot treadle at the point illustrated and long enough



Safety locking device for punch or shear

to reach to the floor when the treadle is in its upper position and the machine not in operation. This safety bar, therefore, prevents any accidental starting of the punch or shear by some one stepping, or a weight falling, on the foot treadle. When desirable to operate the machine, the safety lever is simply swung up out of the way, being held by a U-strap, also clearly illustrated. This device was developed at the Milwaukee shops of the Chicago, Milwaukee, St. Paul & Pacific, and the photograph is furnished by the courtesy of the Milwaukee magazine.

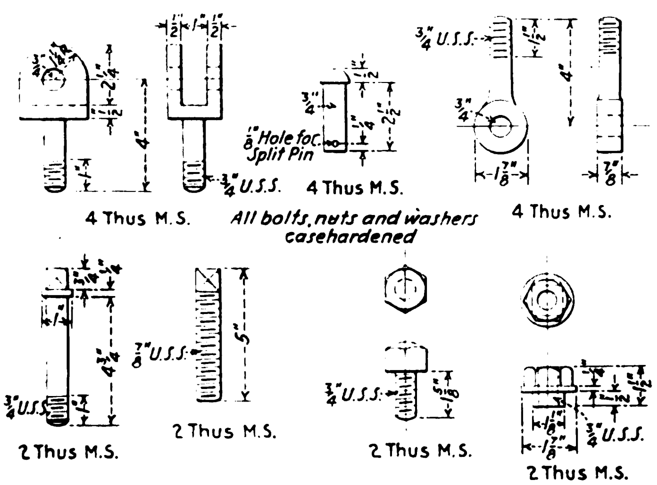
Another illustration, also provided through the courtesy of the Milwaukee magazine, shows a rivet-hammer receptacle which is both a convenience and a safety feature. The device consists simply of a short piece of steel tubing of the proper diameter welded to a circular base plate and easily moved to any point about the shop

Rivet-hammer receptacle which contributes to convenience and safety

where riveting operations may be performed. When, for any cause, it is necessary to stop riveting, the hammer is simply placed vertically in the receptacle instead of being laid on the floor or scaffolding where there is danger of accidental discharge of the rivet set, as well as of the collection of dirt in the hammer. Moreover, the hammer may fall and hit some worker underneath when riveting is being done on a scaffolding. The provision of this rivet-hammer receptacle within convenient reach is an important labor saver and safety device.

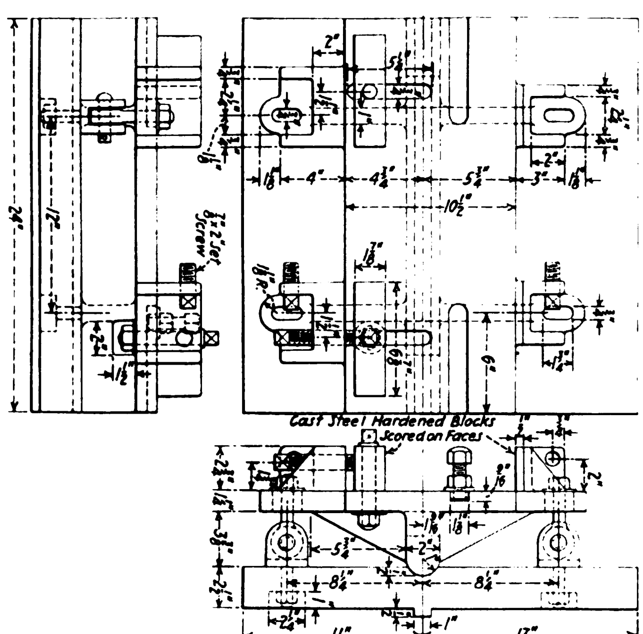
Machining Shoes and Wedges On a Shaper

SHOWN in the two drawings is a fixture for holding shoes and wedges on a shaper. It is made of cast steel and the faces of the hardened blocks for holding



Bolt and stud details used on the fixture for machining shoes and wedges

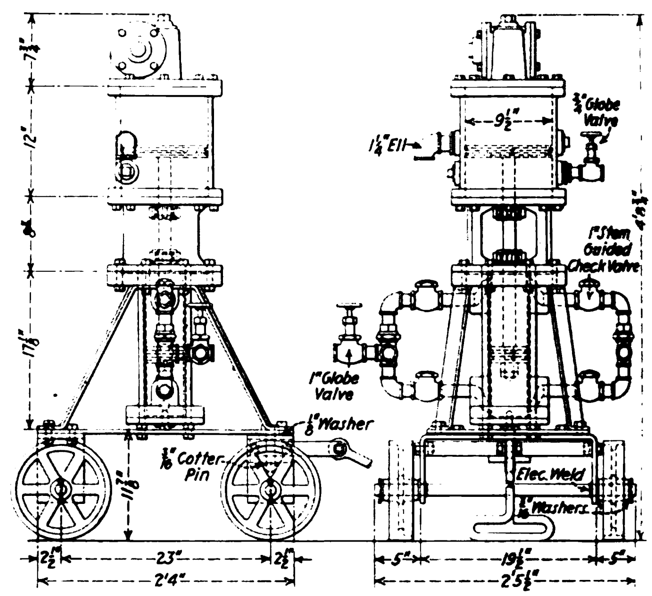
the shoes and wedges are scored as marked on the drawing. All the bolts, nuts and washers used in the assembly are case hardened. The base of the fixture is 24 in. square and the fixture is designed for holding one shoe or wedge at a time. A tongue on the base of the fixture engages a slot in the platen of the machine. The portion of the fixture to which the shoe or wedge is secured can be tilted to suit the angle of the wedge by loosening the nuts on the eye-bolts on one side and tightening the nuts on the opposite side. This fixture is used by a Canadian railroad in one of its principal back shops.



A fixture for machining shoes and wedges on a shaper

Pump for Hydrostatic Tests

THE hydrostatic-test pump shown in the drawing is used by an eastern railroad as standard equipment. It is carried on a four-wheel truck of wrought iron construction. The bracing and truck parts can be forged in the blacksmith shop. The wheels are of cast iron.



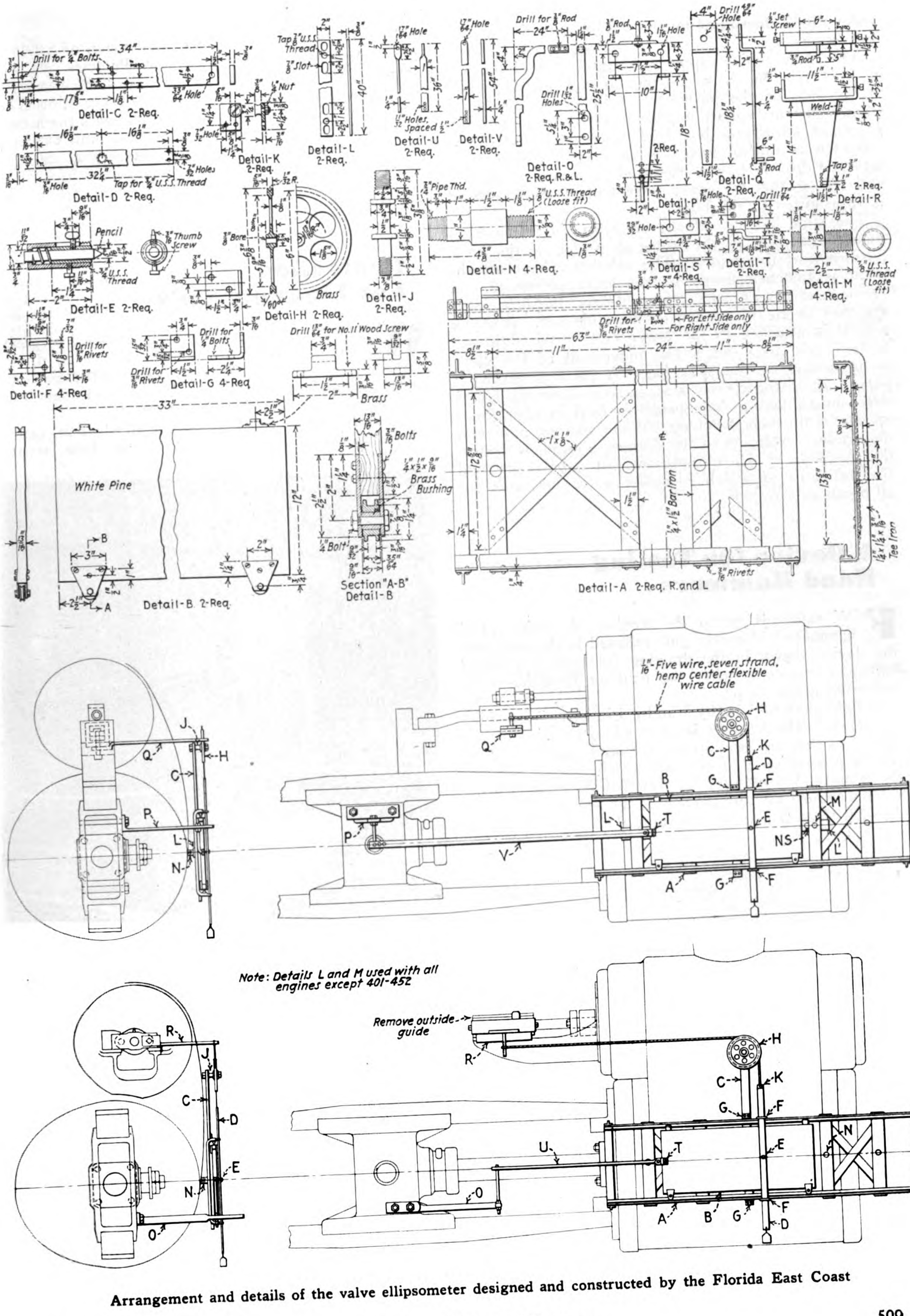
Hydrostatic-test pump

The pump consists primarily of the steam portion of a Westinghouse air compressor, the piston rod of which also serves as the piston rod for the pump. The top head of the pump is W.A.B. part No. 1853, the steam cylinder complete is W.A.B. part No. 1880, and the center piece complete, without the glands, is W.A.B. catalog part 1910. The diameter of the hydrostatic pump can be made to suit the pressure desired.

Constructing a Valve Ellipsometer

AN article by Wm. H. Bohen, mechanical draftsman, Florida East Coast, entitled "Setting Valves on the Florida East Coast," was published in the August, 1931, issue of the *Railway Mechanical Engineer*. In this article, was reproduced a photograph of the machine for recording valve ellipse diagrams. This machine, commonly called an ellipsometer, was designed and built by the mechanical department of the railroad.

Referring to the two drawings, it consists essentially of three parts: A frame which supports a track, a plane board which moves backward and forward horizontally on the track, and a slide bar to which a pencil is secured. The slide bar and pencil move up and down at 90 deg. to the track. This device records the



Arrangement and details of the valve ellipsometer designed and constructed by the Florida East Coast

valve ellipse developed by the locomotive on a card to full scale.

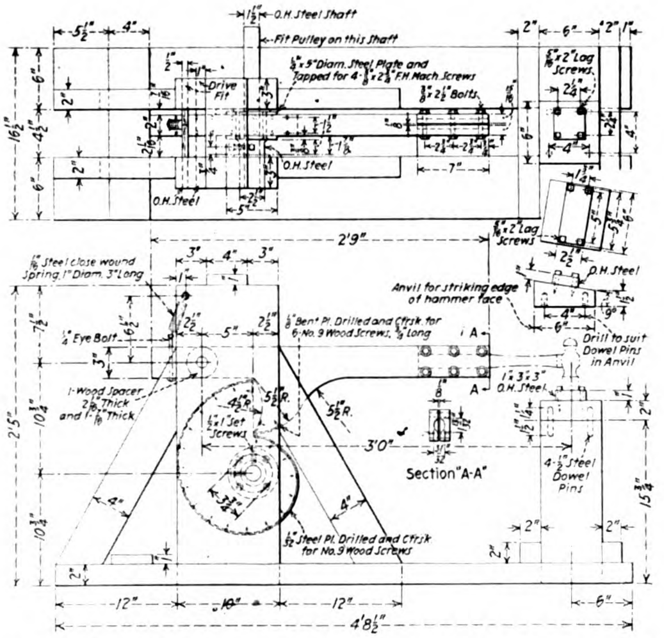
The frame which supports the track is made of 1¼-in. by 1¼-in. by $\frac{3}{16}$-in. T-iron. It is mounted rigidly to the side of the locomotive cylinder by means of plugs which are applied in place of the cylinder-indicator plugs. A white-pine board 12 in. by 33 in. by $\frac{13}{16}$ in., mounted on rollers, moves on the track. The board is attached directly to the crosshead by means of an arm and rod, so that the exact movement of the crosshead is transmitted to the board.

The slide bar, to which the pencil is attached, is mounted midway of the frame at 90 deg. to the track by means of the guides. The valve-crosshead attachment is fastened firmly to the valve crosshead. A $\frac{1}{16}$-in. flexible wire cable is passed over the sheave and attached to the upper end of the slide bar. A 20-lb. weight is attached to the lower end of the slide bar to hold the cable taut. The movement of the valve is duplicated by the slide bar. A piece of drawing paper, cut to the correct size, is secured to the board with thumb tacks. The pencil is held in place by a spring in the pencil holder. When the locomotive is moved one revolution of the drivers, a graph is drawn, the abscissas of which represent piston positions, and the ordinates of which represent valve positions for all points of the cycle.

A Device for Testing Hand Hammers

FEW railroads go to the trouble of testing hand hammers. However, one railroad in the east uses the device shown in the drawing for testing its hand hammers, especially after the hammer head has been redressed in the shop.

A light anvil of 1-in. by 3-in. by 3-in. steel is provided as shown. The hammer is clamped to the arm of the device so that the head strikes the anvil squarely. The arm is pivoted on a ½-in. shaft which extends through the frame. A wood cam faced with 1/32-in. steel plate rotates against the cam portion of the arm which is also faced with steel plate of the same thickness. This cam moves the arm upward against the tension of a 1/16-in. steel, close-wound spring 1 in. in diameter and 3 in. long. The action of the spring causes the hammer to strike the anvil. With this arrangement continuous operation of the drive shaft to the cam causes the hammer to pound the anvil until a definite time limit expires or a failure results. A tachometer can be attached to the drive shaft if desired for the purpose of ascertaining the number of blows struck. The driving cam and arm are constructed of well-seasoned oak.

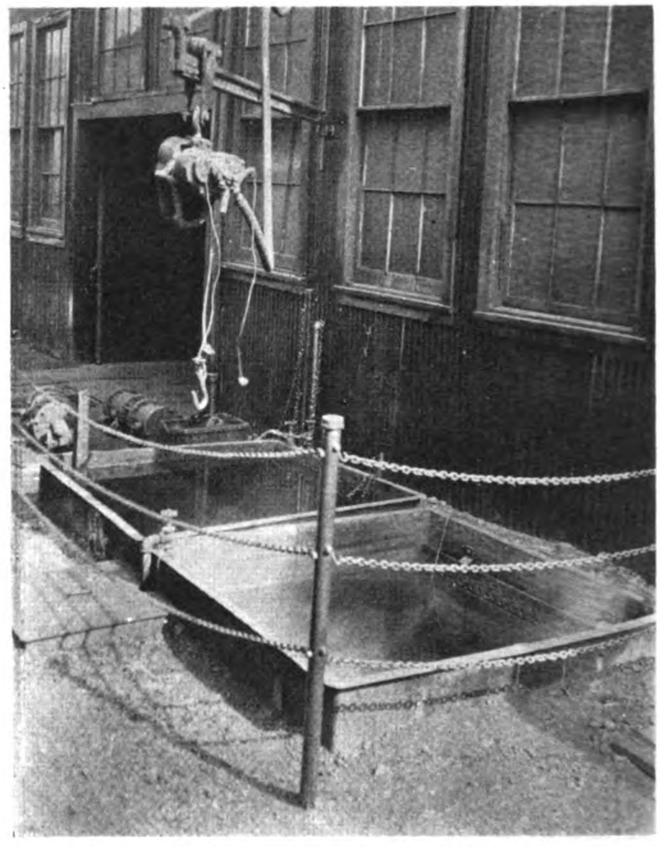


Device used by an eastern road for testing hand hammers

Protection For Cleaning Vats

WHERE cleaning vats, for the removal of grease and dirt from air pumps and parts, driving boxes, etc., are located either flush or slightly above the ground there is a possibility of some workman being seriously burned by falling into them.

A safety fence, as shown in the illustration, can be erected at very little expense. A ⅝-in. chain, secured to the post at one side to prevent it from being lost and equipped with a hook at the other end, can be removed by those engaged in cleaning at the vat to facilitate the handling of material and can be replaced again immediately to prevent personal injury.



A ⅝-in. chain around these low vats may prevent some workman from being scalded

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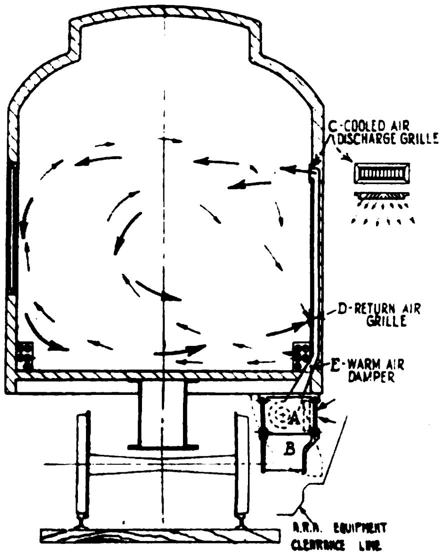
AN AIR-COOLED PRESCRIPTION.—The first prescription of its kind on record was issued by a Washington (D. C.) physician when he recommended to a woman patient who had been overcome by the heat at the capital that she return to her home at Plainfield, N. J., only on an air-conditioned, air-cooled train.

NEW DEVICES

Melcher Unit Air-Conditioning Equipment

A distinctly new type of passenger-car air-conditioning equipment, developed by the Melcher Company, 549 West Washington boulevard, Chicago, comprises essentially air-cleaning, cooling, heating and conditioning apparatus, arranged in a compact design readily applicable to existing car equipment in as many units as needed, dependent



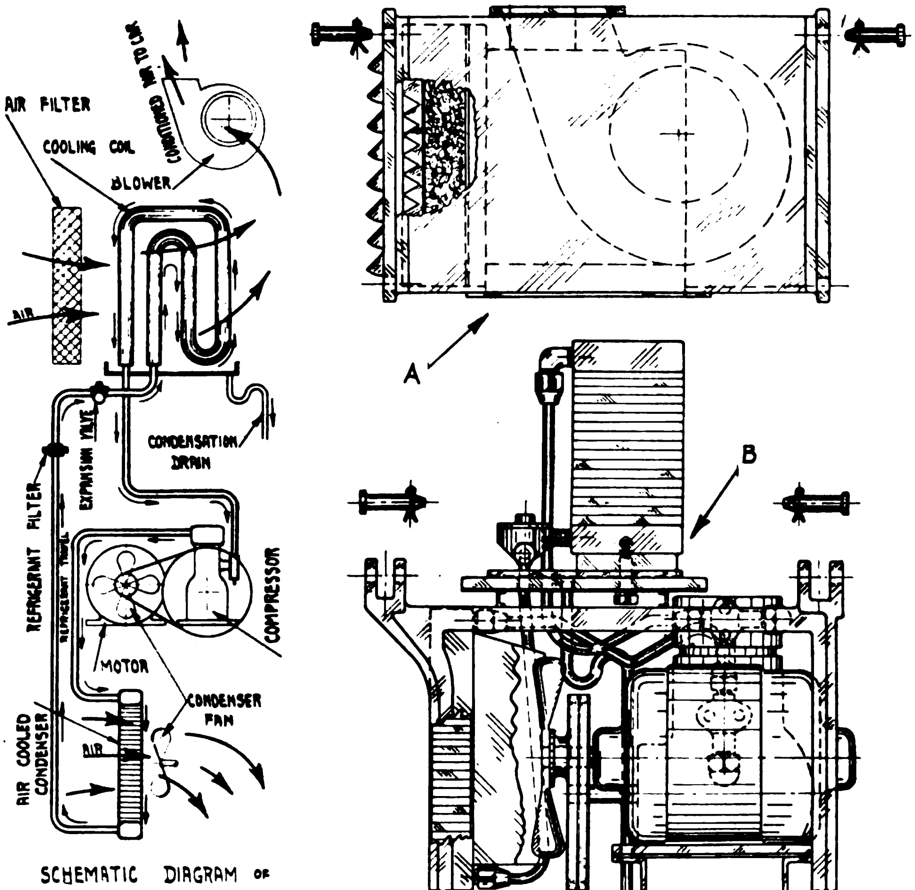
Cross-section of car equipped with air unit—Heavy arrows indicate movement of cooled air—Light arrows show warm-air circulation when heating is required

upon the size of the car and the cooling and heating requirements. The principal advantages of this construction, as indicated by experience with a dining-car installation on the Chicago & North Western, include ease and low cost of installation, operation and maintenance; light weight; small current consumption; reliability; interchangeable, multiple air-cooling units; ready application to existing cars of all types; and high overall efficiency. The high efficiency is said to result from use of the following features of construction: Short air ducts providing minimum friction and heat loss in transit; the conditioning of air only in the zone occupied by passengers, or the space from the floor to a plane six feet above the floor; the use of small motors, rated well within the range of a battery source of power and thus assuring constant operation and uniform car temperatures; the operation of only as many units as may be required and therefore at their point of maximum efficiency; the employment of only two heat conversions, namely, absorption of the heat in the conditioned air by the refrigerant and transfer of the heat in the refrigerant to the atmosphere (see schematic diagram); the compact and strategic relation of the component parts requiring but six feet of refrigerant travel.

Chicago & North Western dining car No. 6916 is equipped with four Melcher Air Units, located two on each side of the car under the dining section, but staggered so that each provides for the distribution of conditioned air in about one-quarter of the length of the dining section. At the same time a minimum amount of undercar equipment changes is required. Power is furnished by a 5-kw. 32-volt generator and two 450-amp.-hr. lead batteries, installed independently of the lighting system so that an exact check might be made of the current consumption of the air units.

All of the usual ventilating devices in the dining section, such as windows, deck ventilators and intakes are kept permanently closed. Referring to the cross-section drawing, *A* is the air section and *B* the refrigerating section of the unit. Outside air is drawn into the air section *A*, cleansed by being passed through a filter, cooled in a cooling coil and discharged by the blower from the unit to a vertical duct, located between the inner and outer sheets of the car side. At a point about six feet above the floor is a discharge grille *C* so constructed as to produce a broad, flat sheet of air and distribute it over a wide area and without draft on passengers. A return air grille is located at *D*. During the heating season, a damper *E*, located in the duct just above the unit, causes the air to be discharged under the heating coils in such a manner that the air movement is transmitted their full length. This tends to cause a uniform distribution of heat, adding much to the comfort of the passengers during extremely cold weather and further increasing the capacity and efficiency of the entire heating system.

The conditioned air, after being discharged into the dining section, passes through the pantry and kitchen where it is discharged from the car by a deck exhaust fan. The return air grille *D*, 8 in. by 12. in., is located about midway between the car floor and the belt rail at each unit and connected with the compartment between the inner and outer car sheets. This compartment is connected by a short duct to the unit and is used for the recirculation of the car air. The usual practice is to set the regulating damper in the unit so as to bring in about 25 per cent of outside air and mix it with 75 per cent recirculated air. The outside air being forced



Air section *A*, refrigerating section *B*, and schematic diagram of Melcher air unit

into the dining section causes a light pressure inside which prevents any leakage of air, gas, or dust from the outside into this section. This pressure also assists in discharging the air through the kitchen, keeping kitchen odors out of the dining section as well as giving the kitchen crew the benefit of the conditioned air. When cars other than diners are equipped, the discharge may be handled at any location desired.

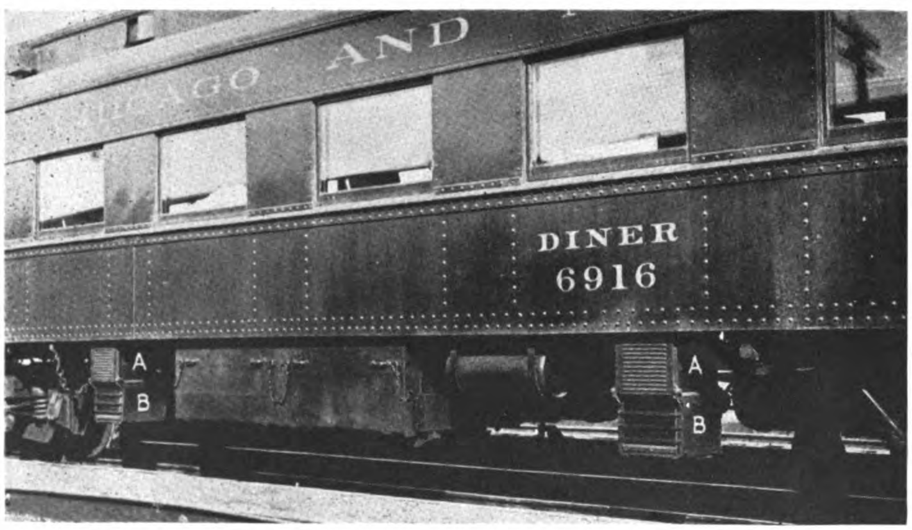
The air unit consists of three sections: a mounting plate, the air section and the refrigerating section. The mounting plate, permanently fastened to the underframe of the car, is of a manifold design and contains ports that are permanently connected with the ducts entering the car. The ports in the plate register with the ports in the unit, and the plates and units are jig-drilled so that all units and plates interchange. For maintenance or any other purpose, any section may be readily detached from the other or the car, by a quickly-detachable but secure connection and the unit replaced or exchanged in a few minutes. Such arrangement eliminates detaining or tying up the car for any maintenance work. The multi-units provide further a protection against complete car failure. Half of the units provided in any one car will carry on the conditioning in a satisfactory manner.

The air section *A* consists of a cast-steel frame, to which is attached a heavy steel enclosure that is lined with one inch of cork. Into this is assembled a moistureproof metal liner and blower housing. The blower is equipped with a 1/8-hp. 32-volt ball-bearing motor, fully enclosed. The air filter is located in the front of the air section and is easily removable for cleaning. The normal cleaning period is every 200 hours of service. The procedure is to flush with hot water and dip in odorless light oil.

The refrigerating section *B* consists of a cast-steel frame with a removable sheet-steel enclosure. Into this is mounted a two-cylinder, fully-enclosed compressor, driven by a 1/2-hp., ball-bearing fully-enclosed, 32-volt, 1,725-r.p.m., heavy-duty motor, through a double V-belt drive. On the front of the section is located a welded radiator-type condenser, through which air is drawn by a four-blade fan mounted on the end of the compressor motor shaft. The air from this fan not only cools the condenser but the motor and compressor as well. On top of the section is located the radiator-type triple-section cooling coil or evaporator, which fits into an air chamber in section *A* when the unit is assembled. Directly attached is an automatic expansion valve. All coils, piping, fittings and parts that contain the refrigerant are tested at three times their maximum working pressure. The system contains three pounds only of methylchloride refrigerating gas, which is odorless and harmless. The cooling coil is mounted in a drain pan where the moisture extracted from the conditioned air, when lowering the humidity, is collected. From the pan, the moisture drains to the ground. All of the component parts of the cooling section are so arranged that they are a part of the cooling section only. If desired, the section may be removed quickly by quickly-detachable supporting connections and disconnecting the two motor lead wires from the terminal block. If desired, this permits the ready removal of the cooling section during the cold winter months.

The weight of the air section is 100 lb., the cooling section 200 lb., the mounting plate 40 lb., or a total of 340 lb. per unit. The complete unit is 29 1/4 in. high, 23 in. long and 24 in. wide. The unit has been designed on a basis of requiring maintenance such as lubrication, belt adjustment and motor inspection but once each year. The current consumption of air section is 3 amp.; the cooling section, 15 to 18 amp. On a four-hour run, four units consumed 320 amp. hr.

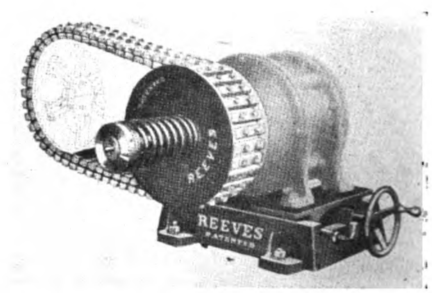
At the present time, the Chicago & North Western dining car units operate eight hours per day. Only three hours of this time current is furnished by axle generators. This service requires additional charge at the terminal which normal service would not require. It will be noted that the combined capacity of all motors on this car is but 2 1/2 hp.



Melcher air units as applied to Chicago & North Western dining car

Reeves Variable-Speed Pulley

The Reeves Pulley Company, Columbus, Ind., has recently developed a variable speed motor pulley which is mounted directly on the motor shaft and forms the driving element between the motor and the driven shaft. The speed control is of infinite range between a ratio limitation of three to one. The power which it is possible to transmit by means of this pulley is from a fractional amount to a total of 7 1/2 horsepower. The speeds are conveniently adjusted by turning a handwheel and any speed desired within the range may be easily secured and maintained.



Speed changes can be made in an infinite number of steps within a ratio of three to one

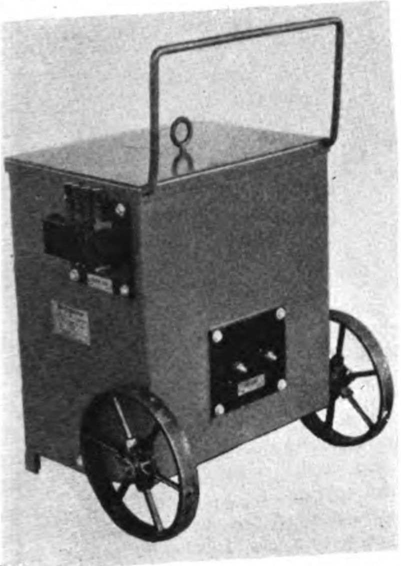
The Vari-Speed motor pulley consists of an assembly of two opposing con-faced discs, one stationary on the shaft and one sliding, and an adjustable power compression spring, all of which is self-contained and mounted on the motor shaft; a special motor base with adjusting handwheel by means of which the motor may be moved forward or backward; a special type of V-belt which contacts on its sides between the con-faced discs and on its flat surface over the driven pulley. Any type of straight face pulley of wood, metal or paper may be used on the driven shaft.

When the motor is at the position on the special motor base nearest to the driven shaft, the V-belt assumes the largest diameter formed by the cone-faced discs and the maximum speed is obtained on the driven pulley. By turning the handwheel, the motor is moved away from the driven pulley. This causes the V-belt to assume a smaller diameter between the cone-faced discs, the sliding disc moving laterally but held in contact with the V-belt by means of the compression spring. Thus the speed of the driven pulley is reduced. When the motor is moved to the position farthest away from the driven shaft the V-belt assumes the smallest diameter and the minimum speed is obtained on the driven pulley. Any speed whatever between maximum and minimum is available, depending upon the

position of the motor. The movement of the motor on the special base is approximately 2 in. on the smallest unit and approximately 6 in. on the largest unit. The V-belt is an adaption on the standard V-belt drive, utilizing not only the sides of the belt but also the flat surface.

Westinghouse Flex Arc A.C. 100-Amp. Welder

An alternating-current arc welding set designed for operation at between 8.5 amp. and 125 amp has recently been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. This welder meets a de-



Westinghouse portable Flex-Arc welding outfit

mand for the economical arc welding of thin gage material such as that encountered in the manufacture of metal furniture, sheet-iron cabinets and containers; in aircraft fabrication work; job and garage repair work, and in the fabrication and erection of ventilating and materials-handling equipment of many kinds.

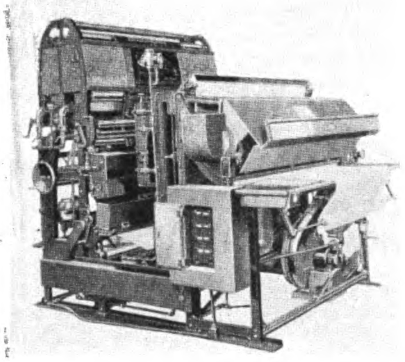
The Flex Arc a.c. welder may be used in conjunction with either bare or coated electrodes from 1/32 in. to 1/8 in. diameter. Many of the ferrous-alloy materials commonly used with reversed polarity direct current are effectively and easily applied in conjunction with this welder. It has also proved successful in the welding of aluminum.

The entire equipment consisting of a special self-cooled transformer, short-wave arc-control system and current regulating details are substantially mounted in a compact welded steel case. With this welder, a special high-frequency arc stabilizing circuit developed by Westinghouse eliminates the usual high open-circuit secondary voltage. The maximum open circuit voltage at the work is only 73 volts, thereby assuring safety to the operator at all times. The short-wave arc-control system eliminates the interference to radio reception usually caused by an a.c. welder. High operating economy is made possible by a high average power factor and extremely low no-load power requirements. Low maintenance is secured by having no moving parts and a totally enclosed construction. It is light in weight, compact and readily portable.

Pease Continuous Blueprinting Machine

The C. F. Pease Company, 813 North Franklin street, Chicago, has recently developed a new model of the Peerless continuous blueprinting machine known as the Model 25. This machine is a model intermediate between the existing Models 20 and 30. The complete Model 25 equipment is composed of three units, the blueprinting machine, the washing machine and the potashing, washing and drying machine. The blueprint machine may be operated independently from the washing, potashing and drying equipment by means of a simple clutch adjustment.

All of the units are manufactured in two sizes for 42-in. and 54-in. work and can be wired to operate on either 220 volts direct or alternating current. The 42-in. machine is equipped with six lamps and the 54-in. machine with seven lamps. Each lamp consumes 6.5 amp. on direct current and 7.5 amp. on alternating curret. The amperage may be increased if faster printing speed is desired. As with the other types of Peer-



The Peerless Model 25 continuous blueprinting machine

less machines, when operating continuously the tracings and paper are laid face up on a continuous roll of paper feeding in at the front of the machine. They are carried upward around a contact glass, past the lamps where the printing operation is performed. After the exposure has been made the tracings are automatically returned to a tray at the front of the machine while the prints are carried through the machine for the subsequent operations of washing, potashing and drying. The machine is so designed that when making single prints both the tracing and the paper are returned to the tray at the front of the machine and the prints may then be washed individually by means of a sheet washer and dryer.

The machine has a speed range of from 4 in. to 12 ft. per min. and is driven by a variable-speed 1/4-hp. motor. Underneath the feed table is a gear shift providing for two speeds, high and low, as well as neutral. Accurate printing regulation is obtained by means of a hand-operated dial at the front of the machine which is connected by means of a sprocket and chain to a rheostat underneath the feed table which provides instant change of printing speed to meet any printing requirement.

After exposure when printing continuously, the roll of paper passes down into a specially designed atomizer water wash consisting of spray jets which direct a pressure spray of water over the entire front and back surface of the paper. After washing, the prints pass over in contact with the chemical roll applicator which is set in a shallow tray at the bottom center of the machine and revolves in the same direction as the paper is traveling. This roll applies potash or negative solution uniformly over the entire surface of the prints. Both potash and hypo solutions are fed automatically into this tray from a container at the rear of the machine and can be alternated in use as required for the class of work being performed. After developing, the prints are again washed by the second spray jet and are again carried over for the final operation of drying.

The dryer in the Model 25 is new in arrangement. It is a twin-radiator air-type dryer consisting of two banks of heating units between which the paper travels around a floating idler roll that can be raised or lowered by means of a crank handle. The machine may be equipped for either gas or electric heat.

Electrode for Building Up Worn Steel

The difficulties usually met when welding with high-carbon electrodes are said to have been eliminated by a special coating, according to an announcement from the research laboratories of the Lincoln Electric Company, Cleveland, Ohio, which has just developed an electrode for building up worn steel wearing surfaces. This new electrode will be known commercially as Hardweld, and it contains about one per cent carbon.

This electrode is designed for use in building up cupped or worn rails, locomotive tire flanges, car wheels, oil-well drill bits, tractor shoes, dipper teeth, dies and other wearing surfaces. The weld produced has a tough dense surface of moderate hardness and will resist wear and abrasion. The special coating will eliminate the objectionable wildness of the arc, so characteristic of ordinary high-carbon welding wire; eliminate the boiling and resulting porosity usually present in high-carbon deposit, and regulate the analysis of the deposit by controlling oxidation and variations of the arc length. When deposited on straight high-carbon steel and allowed to cool naturally, Hardweld will have a hard-

ness within the following range: Rockwell C, 30 to 45; Scleroscope, 40 to 61; Brinell 290 to 425.

An even harder surface may be built up if the bead is peened and a still higher Rockwell C may be obtained by quenching the deposit with cold water. Tests made by depositing a bead of Hardweld on .60 per cent carbon steel using a 3/16-in. electrode at 200 amp. resulted as follows: Cooled naturally, Rockwell C, 33; Peened, Rockwell C, 40; Quenched (from 1,450 deg. F), Rockwell C, 50.

Hardweld should be used with reversed polarity; that is, the electrode should be on the positive side of the generator, and an extremely low arc voltage—20 to 25 volts—will give the best results. The range of current values is wide and can be adjusted for the particular job in hand, although the 3/16-in. electrode is best at 150 to 225 amp. and the ¼-in. electrode should be used at 225 to 350 amp.

Hardweld is packed in 25-lb. tin containers and made in diameters of 5/32 in. 3/16-in. and ¼-in., with a length of 14 in.

Welding Sets Have Many Improvements

The General Electric Company, Schenectady, N. Y., has announced a new line of single-operator welding sets which has been designated the WD-20 line, covering the 100-, 200-, 300-, 400- and 600-ampere ratings respectively. It includes both portable and stationary sets, the basic form being stationary with but a slight change needed to make it portable. Types include those for operation on either alternating or direct current at all standard voltages and, in the case of alternating current, standard frequencies and two- and three-phase gasoline-engine-driven sets will also be available.

Among the principal advantages of the line are the use of two-bearing construction on the a.c. types up to 600 amperes; compactness and light weight—, and greatly improved welding characteristics. The sets are self-excited with a tapped series field for major current adjustments and a shunt-field rheostat giving duplex voltage control.

The latest design of standard a.c. motor has been specially adapted for use in the a.c. sets. Generators are of a new design while retaining all the good features of the past equipment. The direct-current motors are of the latest standard d.c. design.

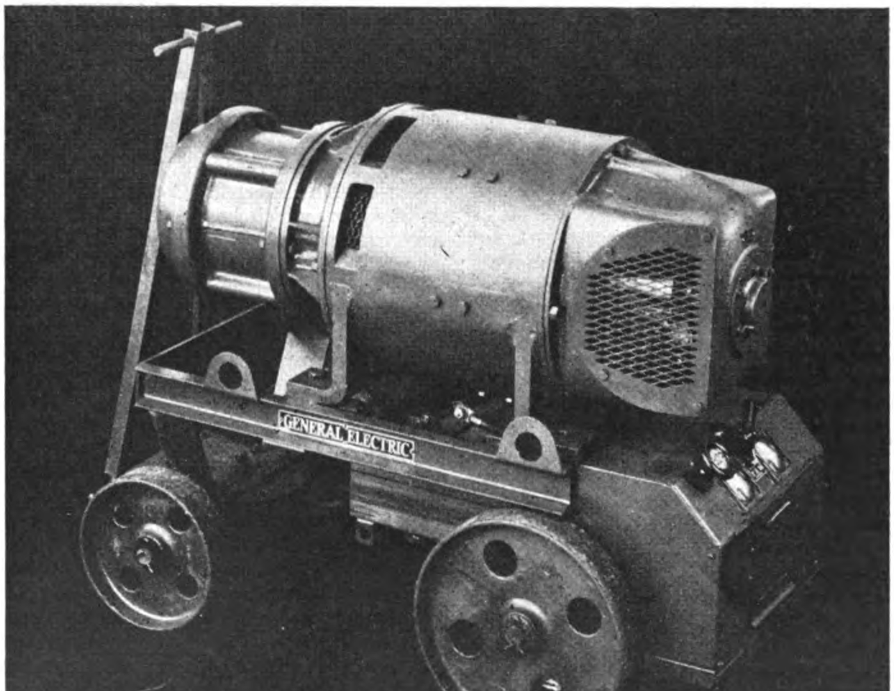
A typical a.c. set consists of a generator with an overhung driving motor mounted on a simple base to which is attached a strong sheet-metal control cabinet enclosing the generator control devices, meters and motor starting equipment. A specially designed transformer-reactor is mounted in the base under the generator. Base supports are arranged to be bolted to the floor or to have axles and wheels readily attached. The whole assembly occupies a minimum of space, a typical 300-amp. a.c. set standing 36 in. high and 50 in. long by 23 in. wide. The weight of such a set is 1,865 lb.

Among the improvements are the following:

1—Practically instantaneous voltage recovery from short circuit to nearly full open-circuit voltage, thus giving a quickly responsive arc.

2—Duplex voltage control by the operator over a wide range with the particular provision of a surplus voltage which can be used when it is necessary to use very long welding leads.

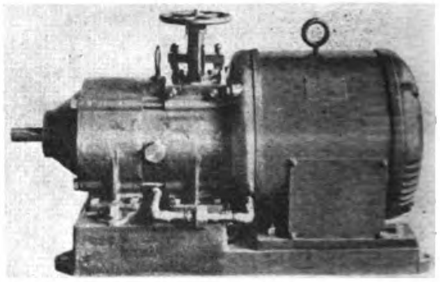
3—Simplicity of operation, a method of control being adopted for which the majority of welding operators have shown a preference.



G-E portable arc-welding set—Type WD-23 generator with induction motor

Electro-Hydraulic Transmission

The American Engineering Company, Philadelphia, Pa., has introduced a small, compact 5-hp. electro-hydraulic transmission. The transmission will develop full rated torque at any speed, whether it be 1 r.p.m. or 1,000 r.p.m. Since the torque is constant the horsepower output varies with the speed of the hydraulic motor. At maximum speed the transmission will develop five horsepower continuously.



The speed of this transmission may be varied from zero to maximum in either direction

In the illustration the hydraulic motor is at the left, the hydraulic pump next to it in the middle, and the electric motor at the right. They are all mounted on a single bed-plate reservoir which contains the oil used in the system. The entire transmission, including motor, is only 30 in. long, 14 in. wide and 16 in. high.

The hydraulic pump and motor are of the Hele-Shaw design and are similar in construction except that the motor has a fixed stroke while the stroke of the pump may be varied from minimum to maximum. The pump and motor are multi-cylindered and handle the fluid in a smooth, continuous stream.

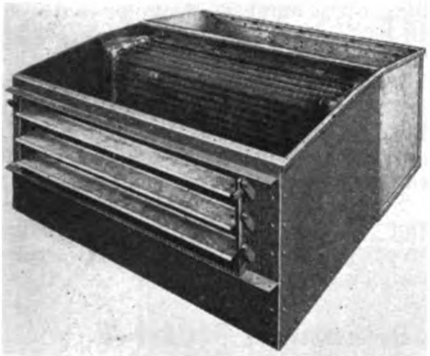
The electric motor drives the pump shaft at a constant speed. Oil is delivered by the pump to the hydraulic motor at a rate corresponding to the stroke of the pump, regulated by the hand wheel shown, or any other desirable hand or automatic control. This is the only point of regulation for there are no controls on the electric or hydraulic motors. Through the handwheel the speed of the hydraulic motor can be varied all the way from zero to maximum in either a forward or reverse direction.

The pump end of the electric motor shaft is fitted with a fan. Oil in the system passes through finned tubing surrounding the fan, consequently its temperature is maintained at a degree commensurate with efficient operation of the transmission.

Air Conditioned in Cars By Steam-Ejector Refrigerating System

An air conditioning system for railroad passenger cars which employs nothing but water and steam as a means of refrigeration has been developed by the Carrier Engineering Corporation, Newark, N. J., and will be made available to the railroads through the co-ordinated efforts of this company, the Safety Car Lighting & Heating Company, New Haven, Conn., and the Vapor Car Heating Company, Inc., Chicago.

No compressor having moving parts is employed, nor is any refrigerant other than water used and thus no additional hazards to passengers are involved in the use of the apparatus. The principle of refrigeration is similar to the principle used in a locomotive water injector. The car is cooled by circulating the air in the car together with fresh air from the outside over cooling coils filled with cold water. As the air is cooled, a part of the moisture in the air is deposited on the coils and allowed to drain off, thus reducing the humidity.



The condenser cooling unit

The temperature is controlled by automatically operated dampers which allow the air to by-pass or entirely pass over the cooling coils according to the temperature requirements in the car.

Positive means for introducing ample quantities of outside air at all times have been provided for ventilation and health, as well as to prevent objectionable odors. This outside air is filtered to remove dust, dirt, cinders, etc., by filters located in the side decks. During periods of low outside temperature the entering air is preheated to a desired temperature.

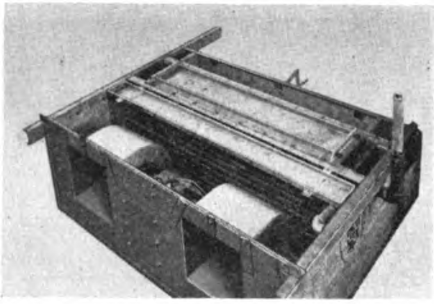
The water which circulates through the cooling coils is cooled by spraying it into a tank in which a vacuum is maintained by a steam ejector. This part of the apparatus is known as the evaporator, for the cooling effect is obtained by the evaporation of a part of the water in the sprays. This water vapor is carried off with the steam of the ejector to a condensing cooling tower where by means of sprays and the rapid circulation of outside air, the heat of the ejector steam and the heat taken from the cooling water is removed. Water for the cooling tower is taken from and returned to a tank called the make-up water tank. Steam for the ejector is taken from the steam train lines and power for operation of circulating pumps and blowers from the 32-volt axle system.

The air conditioning apparatus may be placed in a variety of locations to suit the design of the car. In the demonstration car the air conditioner, which includes the air cooling and heating coils, is located in the clerestory at one end of the car. The cooling tower is similarly located at the opposite end. The evaporator and make-up water tank are located in a locker at one end of the car. The air conditioning unit is about 5 ft. square by 20 in. deep. The dimensions of the cooling tower are approximately 5 ft. by 4 ft. by 2 ft. The evaporator with the make-up tank above are about 7 ft. high and require a floor space approximately 3 ft. square. This portion of the equipment may be distributed under the car in spaces known to be available. The cooled air from the cooling unit is carried in one or two ducts outside along the roof and enters the car through the regular ventilator openings.

The rated capacity of the apparatus is five tons per day—a heat absorption sufficient to change five tons of ice at 32 deg. into water at the same temperature. This capacity is sufficient to maintain comfortable conditions in a passenger car under the most extreme weather to be found in the United States.

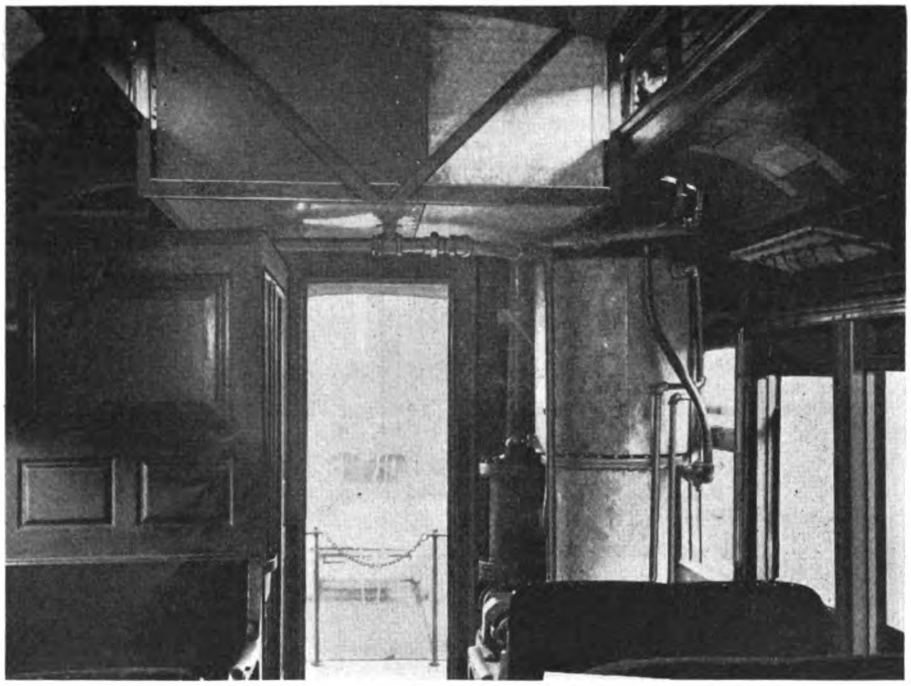
The maximum steam demand is 170 lb. per hour per car which, with a line loss per car of 35 lb., indicates a requirement of 205 lb. per hour for each car from the locomotive. The power required for heating in the winter time is estimated to be a maximum of 260 lb. per hour per car. The total power consumption is said to be considerably less than that of a mechanical system in which power from the locomotive is used to drive axle generators which in turn supply electrical power to operate a compressor. This total for the system, including electric power for the operation of motors and fans, is approximately 11 b.hp.

In the demonstration car two ½-hp. and two ¾-hp., a total of 2½-hp. motors were used for the operation of fans and pumps. These drive, respectively, the air circulating fan, the cooling-tower circulating pump, the cold-water pump and the cooling-tower fans. With air conditioning in effect, the regular car fans are not required. These small disc fans usually represent a load of ⅓ kw. and as they will no longer be used, the additional power required for the air conditioning equipment may be reduced by approximately this amount.



The air-conditioner unit

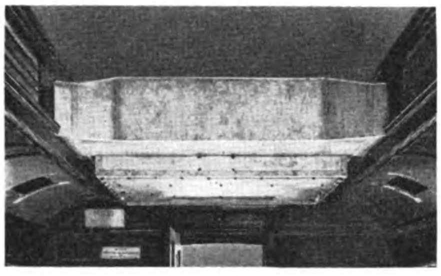
The system has a cold water capacity sufficient to maintain cooling in operation while locomotives are changed and batteries of sufficient capacity can easily be applied to operate the motors during short periods while the generators are not de-



Interior of demonstration car showing condensing cooling tower above and evaporator tank at the right

livering power. Steam and electrical connections are required if the cars are to be on a siding or otherwise without a locomotive for any considerable period of time.

To determine the performance of the unit it was installed in a wooden coach having single windows. The coach was placed in a building in which the outside temperature and humidity could be controlled. Motion of the car was simulated by blowing air alongside the car by means of fans. For purpose of test, the car was filled with passengers and



The air-conditioner unit in place

the unit set to operate at a capacity of 5 tons. With an outside dry-bulb temperature of 106 deg. and a wet bulb temperature of 84 deg., the air inside the car was maintained at a temperature of between 75 and 78 deg. This is more extreme than conditions to be found anywhere in the United States, as a wet bulb of 84 deg. is not incurred with a dry bulb temperature of 106. Under these conditions, about 45 per cent of the capacity of the unit was required to remove moisture from the air and the remainder to cool the air in the car.

The total weight of the complete system, less ducts, is in the neighborhood of 5,000 lb. Other weight would also be incurred by the additional generator and battery capacity, this weight being subject to a considerable variation depending upon the requirements of the run in which the car is used.

The air conditioning unit includes a heating coil so that the system can be used for heating as well as cooling. With this system a majority of the heating apparatus with which present cars are equipped can be eliminated and its weight credited to the new system. In new cars a false ceiling can be used in place of an outside duct system. If desired, a humidifier for adding moisture in the winter time can be added to the heating system.

A group of railway officers and engineers recently witnessed a demonstration of this steam operated air conditioning system at the Carrier plant in Newark, N. J., at which it was also announced that the Silica-Gel Corporation of Baltimore would be associated with the Carrier Corporation and the Safety Car Lighting & Heating Company in the development of air conditioning for railway trains and refrigeration for freight cars.

Fabric-Covered Railway Coaches

An article by L. Lyons of the chief mechanical engineer's office of the Southern Railway, London, England, describing a corridor-type passenger coach finished in a strong fabric, an especially faced leather cloth, was published in the May, 1929, issue of the *Railway Mechanical Engineer*, page 256. This fabric, which is known as Rexine, is manufactured by Messrs. Rexine, Ltd., Manchester, England. During last October the Rexine covered car was placed in the shop for general repair. At that time the car had operated 180,000 miles during a period of two years and three months. The Rexine was found to be in a satisfactory condition, having remained pliable and uniform in color. The coach is now being given a further test.

In addition to the Southern, the London & North Eastern and the Underground District Railway have also made experimental coverings of Rexine to coaches.

With the new Rexine as it has now been developed, a coach can be covered in three days and the work can be done in any temperature. The fabric is stretched over the panels and is not glued. The pigment is anchored to cotton cloth and not to the sides of the car. Any creeping and movement of the joints or panels underneath the covering will not cause the surface to break or crack. Being synthetic, the surface is not affected by heat or cold and, being non-porous, dirt will not get into the pigment but can be easily removed with soap and water. It is only necessary in the application of Rexine to have all raw edges of the covering protected by metal lapping or molding. The body of the car should be so designed that there is no possibility of moisture lodging in corners or depressions where the Rexine is applied.

The use of Rexine for interiors has been well established in England. Scratch-proof Rexine is used for the lining of all interior panels and the ceilings of a number of motor buses of British manufacture. The Southern has standardized on scratch-proof Rexine for the lining of door panels of passenger cars, while the London & North Eastern uses Stipplex, one of the latest developments in Rexine designs, to line certain panels in its sleeping cars.

Stipplex gives a stippled paint effect and can be used effectively to produce wood grains and one- and two-color metallic finishes.

Hammond Multi-V Belt Grinder

The Hammond Machinery Builders, Inc., Kalamazoo, Mich., have recently developed a new machine for tool, casting and general-purpose grinding. This machine differs from many types of electrically driven grinders in that the power is transmitted from the motor to the spindle by means of multi-V belts. The motor is mounted at the rear of the pedestal. This construction permits a spindle housing of small diameter, allowing considerably more clearance between the grinding wheel and the spindle housing. The machines can be used in tandem and operated at different speeds inasmuch

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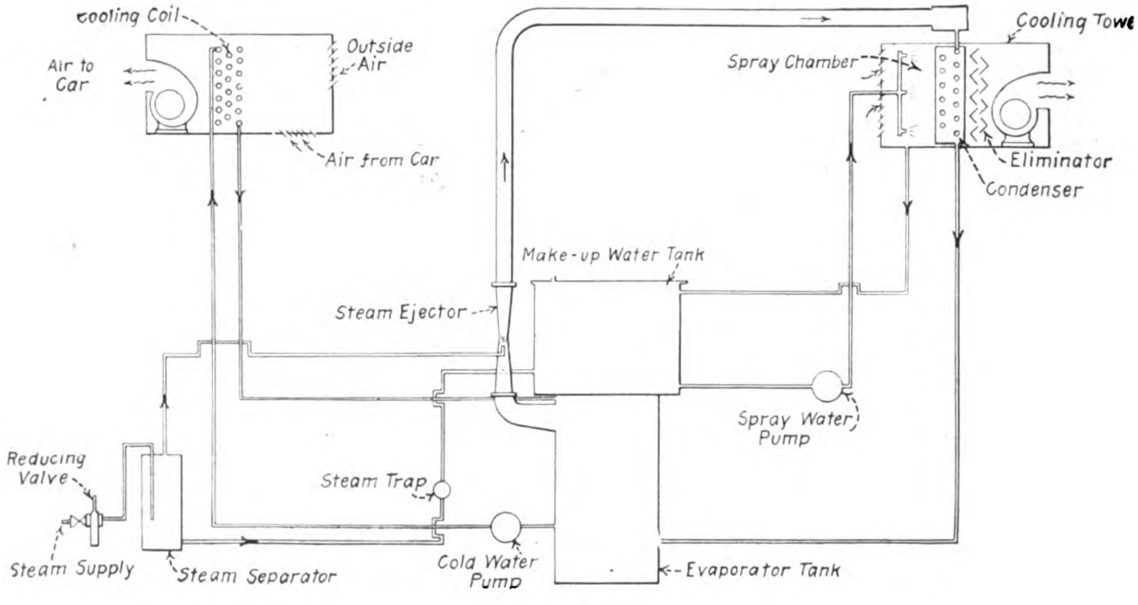


A Diagrammatic view of Carrier-Safety-Vapor system of air conditioning for passenger cars

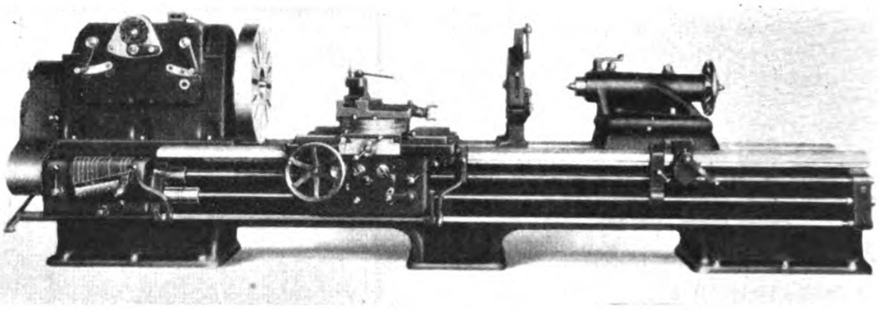
as the speed of the spindle is not limited to the speeds of the alternating-current motors. The grinder can be supplied with 10-, 12-, 14-, or 16-in. diameter wheels in one-, two-, three-, and 5-horsepower capacity. A feature of this machine is the fact that the whole spindle assembly can be removed from the pedestal without disturbing any mechanical part. This is an advantage when it is necessary to renew belts. The spindle is mounted in oversize ball bearings which run in a bath

The power for driving the spindle is transmitted by V-belts

of oil and are protected from dirt and grit by means of a double labyrinth seal. Universal adjustable wheel guards are standard equipment. These are adjustable to the wear of the wheel and a clearance between the grinding wheel and the top of the guard can be maintained at a safe dimension as the wheel wears. Shatterless glass adjustable eye shields are also standard equipment. The motor on this machine is a completely enclosed type, ventilated by means of a patented motor air cleaner.

Sidney Heavy Duty Engine Lathes

The Sidney Machine Tool Company, Sidney, Ohio, has recently developed two new designs of the Tritrol 30-in. and 36-in. heavy duty engine lathes, which are distributed by Joseph T. Ryerson & Son, Inc. Some of the most interesting features are, the Tritrol direct-reading 16-speed control; the totally enclosed anti-friction self-oiling gear box; anti-friction end gearing and the anti-friction centrally oiled apron. One of the biggest advances in engine lathe design is found in the method of guiding and holding the carriage to the bed. The carriage is guided on the bed by large vees front and back and a wide flat bearing is placed under the bridge where the tool pressure comes. The gibs are located in the center of the bed on square guides which not only keep the carriage from lifting under the heaviest cuts, but also strengthens the bridge considerably. The bed is of four-wall construction, cast from .50 to .60 per



A side view of the Sidney 30-in. Tritrol engine lathe

cent carbon alloy steel with 1.00 per cent nickel content.

The headstock is of full herringbone gear design and operates on anti-friction bearings. All bearings are adjustable for take-up from outside the headstock without removing the cover. A positive force-feed lubrication system assures a constant flow of clean, fresh lubricant to all bearings and moving parts in the headstock.

The spindle and all drive shafts are made from alloy-steel forgings. The spindle is of exceptionally large diameter. An exclusive design of positive jaw clutch together with the herringbone gears in the headstock makes possible sudden spindle-speed changes without danger of damaging the work, tool or machine.

The gear box is dust proof and chip proof. It is lubricated by a central oiling system.

The heavy double-wall apron is equipped with anti-friction bearings. The patented Tritrol non-revolving snap-lever apron controls can be thrown out or in with a flip of the finger, yet they will not slip out of engagement under the heaviest loads. A lever on the aprons provides a reverse to all feeds without reversing the spindle.

Hercules Portable Belt Sander

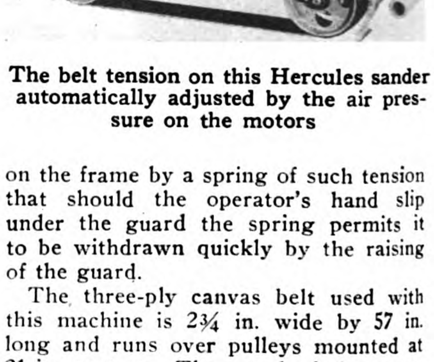
The Buckeye Portable Tool Company, Dayton, Ohio, has recently placed on the market a Hercules portable belt sander used for smoothing down welds, sanding auto bodies, smoothing up large steel dies, finishing metal, wood and stone surfaces and smoothing up large bronze or brass plaques and tables. It will work well on either flat, convex or concave surfaces—a special attachment for concave surfaces is an added feature to the sander equipment.

The Hercules belt sander is suspended over the job by a suspension pulley and cable, and is easily handled by one man. This sander is powered by two No. 300 Hercules rotary air motors developing in excess of 1⅓ hp. each, at 85 lb. air pressure. The motors are directly back of each pulley and are directly connected.

The motors are forced out to tighten the belt by means of two small air cylinders mounted on the main frame. When the throttle is opened the air pressure passes first into these cylinders, tightening up the belt, then into the motors proper. These cylinders hold the belt at uniform tension at any deflection. When the throttle is shut off all tension on the belt is relieved, but it is still held firmly enough to stay on the pulleys. No strain is on the belt except when the sander is in action.

When it is necessary to change the belt the operator merely presses two small pressure release buttons on top of the main frame which releases the pressure in the cylinders, thereby allowing the motors and pulleys to drop toward the center. In this manner the belt is lifted off easily and another applied. When the new belt is on, the operator opens the throttle and the aforementioned cylinders take care of the belt tension automatically.

The wheel guards are flexible, being held in place where they are mounted



The belt tension on this Hercules sander automatically adjusted by the air pressure on the motors

on the frame by a spring of such tension that should the operator's hand slip under the guard the spring permits it to be withdrawn quickly by the raising of the guard.

The three-ply canvas belt used with this machine is 2¾ in. wide by 57 in. long and runs over pulleys mounted at 21-in. centers. The speed of the motor is 300 r.p.m. The total weight of the sander is 46 lb.

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Among the
Clubs and Associations

NEW ENGLAND RAILROAD CLUB.—T. N. Perkins, chairman of the board of the Boston & Maine, will address the New England Railroad Club on October 13 at 6:30 p. m. at the Copley-Plaza Hotel, Boston, Mass.

PACIFIC RAILWAY CLUB.—The members of the Pacific Railway Club will meet on Friday evening, October 16, at Sacramento, Cal., for which meeting a program of interest to those in all branches of the railroad profession is being arranged.

CLEVELAND RAILWAY CLUB.—Air Brakes will be the subject discussed at the meeting of the Cleveland Railway Club which will be held at 8 p. m. on October 12 at the Brotherhood of Railroad Trainmen's building, Cleveland, Ohio.

CANADIAN RAILWAY CLUB.—E. R. Mellenger, president, E. R. Mellenger, Ltd., Montreal, will present a paper on Recent Designs of Diesel Engines for Locomotives at the meeting of the Canadian Railway Club which will be held at 8 p.m. on October 19 at the Windsor Hotel, Montreal. A dinner will precede the meeting at 6:30 p.m.

EASTERN CAR FOREMEN'S ASSOCIATION.—The Chilled Iron Wheel will be discussed by G. W. Doak before the meeting of the Eastern Car Foremen's Association which will be held on October 23 at 8 p. m. at the Engineering Societies' building, 29 West Thirty-ninth street, New York. Moving pictures will show the manufacture of chilled iron wheels.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Capt. John W. Gorby of the Executive Staff of the Century of Progress Exposition, in charge of railroad and marine exhibits, will present a paper on The Railroads' Participation in a Century of Progress at the meeting of the Car Foremen's Association of Chicago which will be held at 8 p.m. on October 12 at the Auditorium Hotel, Chicago.

THE DIVISION OF SIMPLIFIED PRACTICE of the National Bureau of Standards has announced that simplified practice recommendation No. 51-29, covering die head chasers (for self-opening and adjustable die heads) has been reaffirmed by the standing committee of the industry, without change, for another year. It is estimated that this recommendation has been instrumental in effecting a reduction of approximately 75 per cent in the number of stock varieties of this product.

WESTERN RAILWAY CLUB.—At the initial fall meeting of the Western Railway Club, scheduled to be held at the Hotel Sherman, Chicago, on October 19, the new developments in the air conditioning of passenger cars will be discussed. A representative of the Carrier Engineering Corporation will describe the new steam ejector system developed by Carrier, illustrating his talk with lantern slides. Representatives of the York Ice Machinery Corporation, York, Pa., and other manufacturers of air-conditioning apparatus will also be present and will describe the latest improvements in their respective equipments.

INTERNATIONAL RAILWAY CONGRESS.—The next International Railway Congress will be held at Cairo, Egypt, in 1933. Among the reports and reporters will be the following:

The Relationship Between the Vehicle and the Track, to Ensure Safety at High Speeds—Dr. S. Okhodo, director of the Bureau of Maintenance and Improvement; Dr. S. Matsunawa, chief of the Railway Research Office, and Dr. K. Asakura, chief of the rolling-stock section: all three of the Department of Railways, Government of Japan, Tokyo.

Methods to be Used to Increase the Mileage Run by Locomotives between Two Repairs, Including Lifting—Sir Henry Fowler, K.B.E., assistant to vice-president for works, London, Midland & Scottish of Great Britain, Derby, England.

Electrification of Railways from an Economic Point of View. Selection of Sites for Generating Stations. Choice of the Kind of Current. Safety Precautions, etc.—S. Withington, electrical engineer, New York, New Haven & Hartford, New Haven, Conn.

All-Metal Rolling Stock. Use of Light Metals and Alloys. Use of Autogenous Welding—H. N. Gresley, C.B.E., chief mechanical engineer, London & North Eastern of Great Britain, King's Cross Station, London, N. 1.

Allocation of Freight Rolling Stock. Investigation into the Turn-Around of Freight Equipment. Separation of the Elements Included in It. Methods of Reducing the Period of Turn-Around—F. H. van Rijckevorsel, ingenieur, chef de service des transports, Netherlands Railways, Maliesingel, 76, Utrecht, Holland.

Automatic Train Control and Train Stop. Track Equipment. Locomotive Fittings. Methods Used for Repeating Signals on the Locomotives. Devices Intended to Ensure the Attention of the Drivers—G. H. Crook, assistant to signal engineer, Great Western of Great Britain, Reading, England.

Use of Rail Motor Cars on Secondary Railway Lines—A. D. J. Forster, assistant railway commissioner, New South Wales, Government Railways, Sydney, Australia.

MECHANICAL MEETINGS TO BE CONSOLIDATED.—In order to discuss plans for future annual meetings, the American Railway Association, Mechanical Division, Subcommittee on Consolidation of Mechanical Conventions, held a joint meeting on September 14 at Chicago, with representatives of the following associations: Air Brake, American Railway Tool Foremen's, Association of Railway Electrical Engineers, Car Department Officers', Equipment Painting Section, International Railroad Master Blacksmiths', International Railway Fuel, International Railway General Foremen's, Master Boiler Makers', Traveling Engineers' and Allied Railway Supply. The subcommittee, representing the General Committee of the Mechanical Division, included John Purcell, assistant to the vice-president, Atchison, Topeka & Santa Fe, who presided; E. B. Hall, general superintendent of motive power and machinery, Chicago & North Western; F. R. Mays, general superintendent of motive power, Illinois Central, and V. R. Hawthorne, secretary, Mechanical Division. The various associations were represented by their respective presidents and secretaries, other officers being present in a few instances. ¶After a general and complete discussion of the problems involved, it was unanimously decided that none of the associations represented would have an exhibit of railway appliances and equipment during the year 1932. ¶It was decided that the general plan of consolidated meeting arrangements, as proposed by the Mechanical Division, be adopted, with the understanding that the duration of meetings and arrangement of groups might be modified. This general plan, as covered in a report dated May 23, 1931, to the General Committee, suggested that in the interests of economy, all meetings be held during one week early in May (the first or second week), the following associations shown in Group I meeting during the first three days of the week, and the associations in Group II during the last three days. ¶*Group No. 1*—International Railway General Foremen's Association; Traveling Engineers' Association; The Air Brake Association; American Railway Tool Foremen's Association, and International Railway Fuel Association. ¶*Group No. 2*—International Railroad Master Blacksmiths' Association; Car Department Officers' Association; Master Boiler Makers' Association; Association of Railway Electrical Engineers, and A. R. A. Equipment Painting Section. ¶Discussion at the meeting on September 14 indicated that it might be desirable to modify this grouping of associations in some instances and possibly facilitate the handling of registrations and other details by arranging for the associations in Group I to meet during the last three days of one week and Group II during the first three days of the following week. The desirability of each association's maintaining its identity and meeting in separate rooms of some hotel which can accommodate a general exhibition of railway equipment and supplies was emphasized. ¶It was decided upon motion that a committee be appointed, consisting of one representative from each association, to work with the subcommittee of the Mechanical Division on the details of this arrangement, each representative to be given full power to act for his association. ¶The representatives of the Association of Railway Electrical Engineers voted in the negative on this proposition, stating that in their opinion their association should convene with the Electrical Section of the Engineering Division, American Railway Association, rather than with the other organizations covered in this general plan.

(Continued on next left-hand page)

Club Papers

Air Brakes

Manhattan Air Brake Club.—The Manhattan Air Brake Club held its first meeting of the season on Friday, September 18. The following subjects were discussed: Lubrication of Air Brake Equipment; U-12-BC Universal Valve; Freight Brake Equipment; Type B Oil Cup; Electro-Tite Hose Coupling, and Application Piston Packing Cup. The subject of lubrication of railway equipment consisted of a report by a committee appointed at the meeting of the club held in May, 1931. The recommendation and conclusions of this committee will appear in a later issue.

Some Car-Department Problems

Car Foremen's Association of Chicago.—Meeting held September 14, at the Great Northern hotel, Chicago. Subject "Some Car-Department Problems," presented by T. W. Demarest, general superintendent of motive power, Pennsylvania, Western Region, Chicago. ¶Under this general subject, Mr. Demarest covered so many important aspects of car department operations that his paper will unquestionably constitute one of the most valuable presented before the association during the coming year. About 200 members were present when the speaker was introduced, and the entire evening was devoted to the presentation of his prepared address, which was interspersed with extemporaneous comments which added greatly to the interest of the meeting and were received with the keenest appreciation. ¶Mr. Demarest's remarks, which will be abstracted more fully in subsequent issues of the *Railway Mechanical Engineer,* may be roughly summarized under three heads, namely, general problems relating to the design, construction and maintenance of equipment; the problem of car interchange; and the training and development of personnel. Many striking statements were made and explained in the address. Regarding standard cars, Mr. Demarest said: "The inertia of the railroads, themselves, comparatively minor differences in construction and dimensions based on individual opinion, and perhaps the influence of the traffic department, have restricted the more general construction of such types as have been adopted. It is going to take direct action and complete agreement on the part of the railway presidents, themselves, to get results in this particular." Regarding interchange, Mr. Demarest said: "I am going to make, perhaps, a strange statement—I hope to see the day when our car interchange rules disappear; that in our large interchange centers we depend on a central bureau clothed with proper authority and not subservient to local officers or rules; that their inspection be based on car condition and lading, fit to go to destination, with the delivering line compelled to assume its full obligation in this respect; and that the fullest use be made of such bureaus." Regarding supervision, Mr. Demarest said: "The easy man to educate is the car foreman; the hard men to educate are his superiors." The entire address was a challenge to car-department supervision, from men in the highest ranks to the humblest inspector, which will not soon be forgotten.

Journal-Box Packing Renovation

Cleveland Railway Club. — Meeting held September 14 at Cleveland. Paper on the Renovation of Journal-Box Packing presented by Leo C. McNamara, president Journal-Box Servicing Corporation, Indianapolis, Ind. ¶In introducing his subject, the speaker reviewed some of the past history of the developments of railway-car journal boxes and packing, outlining the difficulties which the railroads have had in servicing journal boxes and some of the developments that have been made during the past few years in improving the lubricants and packing used. Mr. McNamara outlined the work that has been done in developing equipment for the renovation of car journal packing and presented comparative statistics to show the analyses and service obtained in journal boxes when using new oil, oil renovated by hand methods and oil renovated by a modern renovation process. Other data presented showed a comparison of oil renovated by the process recommended by the company with which the speaker is connected with the A. R. A. specifications for renovated oil and indicated in his comments that, while the A. R. A. specifications were considered somewhat drastic when first published, progress in renovation has been made to such an extent that there is now not only no difficulty in meeting the requirements, but that the A. R. A. Committee on Lubrication could undoubtedly go still further than they have in the rigidity of requirements without the railroads having any difficulty in meeting them. ¶A great part of Mr. McNamara's paper was taken up in consideration of the causes of hot boxes and in concluding his paper he said: "To sum up the hot-box problem, the first thing necessary is clean and properly prepared packing and that the oil be properly distributed so that each box gets the right proportion; that the journal-box is clean, that the brass, the wedge, and the roof of the box are in proper condition; that every precaution is taken to keep dust out of the box and from the journal and brass when applying, and that the box is packed according to A.R.A. Rules. When this is done, it is pretty safe to say the cars will run free from trouble."

The Oil-Electric Locomotive

The Railway Club of Pittsburgh.—Meeting held at the Fort Pitt Hotel, Pittsburgh, Pa., September 4. Paper by William Kromer, designing engineer of the H. K. Porter Company, on "The Place for the Oil-Electric Locomotive in Modern Railway Transportation." ¶Mr. Kromer opened his remarks by referring to the prediction made many years ago when the first electric locomotive had demonstrated its adaptability for railroad service, that the steam locomotive would soon be a thing of the past, and remarked that probably similar predictions have been made since the entrance of the oil-electric locomotive into the field of modern transportation. Neither of these things

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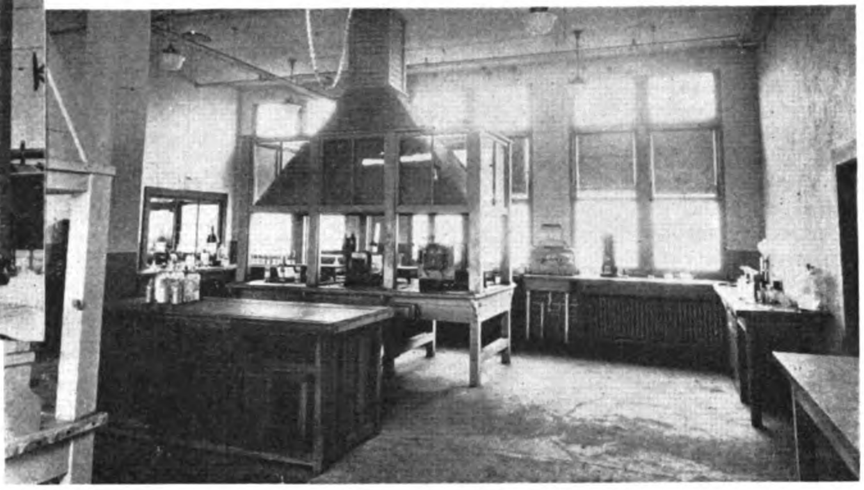
* * *

Covered all-steel dump car for transporting coke—Built for the German State Railways by Orenstein & Koppel A-G Berlin—On exhibition at the Leipzig Trade Fair

FORGINGS Quality Always



FROM the very start, the billets used for Alco Forgings are carefully inspected and tested by men who have had years of experience in the inspection of locomotive materials.

Drillings are taken from all heats—such samples being taken from at least six different billets representing different localities in the ingot. Complete chemical determinations are then made before the billets are released for shipment.

In addition to the usual analysis made at a point one half way between center and edge, a complete analysis is made from drillings taken at the dead center of the billet. This enables us to make certain as to the amount of segregation. Should the analysis show an abnormal segregation, the material is not accepted.

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All heats of high carbon steel are subjected to a tensile test. This test gives an excellent indication as to the physical properties of the steel and the soundness thereof.

Alco has long recognized that to insure the best in quality requires much more than the mere writing of specifications. Alco supports this with high quality raw materials, efficient manufacturing facilities, rigid inspections and scientific laboratory tests.

American Locomotive Company
30 Church Street New York N.Y.

has happened, said the speaker, but there is a place in modern railway transportation and in industrial plants which an oil-electric locomotive can fill more economically and effectively than a steam locomotive. Data, charts and lantern slides were shown comparing the operations of oil electric and steam locomotives. Mr. Kromer discussed at some length the various factors entering into the operation of oil electric locomotives and discussed comparative costs of operation between the oil and steam. In summarizing his several points, Mr. Kromer said that the determination of whether an oil-electric is suitable for application to any particular service hinges on the answer to three questions: First, what power will be required; second, what duty cycle is involved and, third, will the first cost differential and the interest and depreciation charges be overcome within a reasonable time by the savings effected in operation? ¶In discussing the type of service to which the oil-electric locomotive is adaptable, Mr. Kromer mentioned the following: Outlying points, or small terminals; second, on branch lines where turn-around service is involved; third, local branch passenger service or mixed runs where the motor car is not suitable but where the motor car could not do the way switching or the shifting at terminals; fourth, for operation on the sharp-curved tracks around industrial plants and at certain terminals; fifth, switching in warehouses and shops where cleanliness or fire risk is important; sixth, for operation over yard and branch-line tracks and structures which are too light for road locomotives. ¶At the conclusion of the paper, several lantern slides of different types of oil- and gasoline-electric locomotives were shown.

The Coffin Feedwater Heater System

Cincinnati Railway Club.—Meeting held September 8 at the Hotel Gibson, Cincinnati, Ohio. Paper by George W. Usherwood on the subject "The Coffin Feedwater Heater System." ¶Mr. Usherwood's paper gave a complete description of the Coffin feedwater heater system for locomotives consisting of a main closed type heater of semi-circular form, which conforms to the radius of the smokebox to which it is applied; an auxiliary open type heater, which is located in a forward corner of the tender in which dissolved oxygen is liberated and oil removed from the water before passing to the pump; a centrifugal type boiler feed pump; a control valve, and the necessary fittings and connections. The paper described the operation of the system in detail. ¶In his paper Mr. Usherwood referred to an endurance test run on the Frisco in which the locomotive operated for 31 days, or 9,700 miles, with no work of any description being performed on the feedwater heater system. He referred to the fact that numerous records are available showing mileage well in excess of 100,000 with no attention but cleaning and oiling.

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

Air-Brake Association.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

Allied Railway Supply Association.—F. W. Venton, Crane Company, Chicago.

American Railway Association.—Division V. —Mechanical.—V. R. Hawthorne, 59 East Van Buren street, Chicago. Meeting June 23, 24 and 25, Congress Hotel, Chicago.
Division V.—Equipment Painting Section.—V. R. Hawthorne, Chicago.
Division VI.—Purchases and Stores.—W. J. Farrell, 30 Vesey street, New York. Next meeting May 19, 20, 21, Biltmore hotel, Atlanta, Ga.
Division I. — Safety Section. — J. C. Caviston, 30 Vesey street, New York.
Division VIII.—Car Service Division.—C. A. Buch, Seventeenth and H. streets, Washington, D. C.

American Railway Tool Foremen's Association.—G. G. Macina, 11402 Calumet avenue, Chicago.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.
Railroad Division.—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York.
Machine Shop Practice Division. — Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.
Materials Handling Division.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.
Oil and Gas Power Division.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.
Fuels Division.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

American Society for Steel Treating.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

American Society for Testing Materials.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa.

American Welding Society.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

Association of Railway Electrical Engineers. —Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

Canadian Railway Club.—C. R. Crook, 2276 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month except in June, July and August, at Windsor Hotel, Montreal, Que.

Car Department Officers Association.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

Car Foremen's Association of Chicago.—G. K. Oliver, 2514 West Fifty-Fifth street, Chicago. Regular meeting, second Monday in each month except June, July and August, Great Northern Hotel, Chicago, Ill.

Car Foremen's Club of Los Angeles.—J. W. Krause, 608 South Main street, Los Angeles, Cal. Meetings second Monday of each month except July, August and September, in the Pacific Electric Club building, Los Angeles, Cal.

Car Foremen's Association of Omaha, Council Bluffs and South Omaha Interchange.—Geo. Kriegler, car foreman, Chicago, Burlington & Quincy, Sixteenth avenue and Sixth streets, Council Bluffs, Iowa. Regular meetings, second Thursday of each month at Council Bluffs.

Car Foremen's Association of St. Louis.—F. G. Weigman, 720 North Twenty-third street, East St. Louis, Ill. Regular meeting first Tuesday in each month, except July and August, at American Hotel Annex, St. Louis, Mo.

Central Railway Club of Buffalo.—T. J. O'Donnell, executive secretary, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meeting, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

Cincinnati Railway Club.—D. R. Boyd, 453 East Sixth street, Cincinnati. Regular meeting second Tuesday, February, May, September and November.

Cleveland Railway Club.—F. L. Frericks, 14416 Alder avenue, Cleveland, Ohio. Meeting second Monday each month, except June, July and August, at the Auditorium, Brotherhood of Railroad Trainmen's building, West Ninth and Superior avenue, Cleveland.

Eastern Car Foremen's Association.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings fourth Friday of each month, except June, July, August and September.

Indianapolis Car Inspection Association.—P. M. Pursian, 823 Big Four building, Indianapolis, Ind. Regular meetings first Monday of each month at Hotel Severin, Indianapolis, at 7 p.m. Noon-day luncheon 12:15 p.m. for Executive Committee and men interested in the car department.

International Railroad Master Blacksmith's Association.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

International Railway Fuel Association.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago.

International Railway General Foremen's Association.—William Hall, 1061 W. Wabash street, Winona, Minn.

Louisiana Car Department Association.—L. Brownlee, 3730 South Prieur street, New Orleans, La. Meetings third Thursday.

Master Boilermakers' Association. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

Master Car Builders' and Supervisors' Association.—See Car Department Officers Association.

National Safety Council—Steam Railroad Section.—W. A. Booth, Canadian National Montreal, Que. William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

New England Railroad Club.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting, second Tuesday in each month, excepting June, July, August and September. Copley-Plaza Hotel, Boston.

New York Railroad Club.—Douglas I. McKay, executive secretary, 26 Cortlandt street, New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York.

Pacific Railway Club.—W. S. Wollner, P. O. Box, 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

Pueblo Car Men's Association.—I. F. Wharton, chief clerk, Interchange Bureau, Pueblo, Colo.

Railway Business Association. — Frank W. Noxon, 1124 Woodward building, Washington, D. C.

Railway Car Men's Club of Peoria and Pekin.—C. L. Roberts, chief clerk, Peoria & Pekin Union Railway, 217 Lydia avenue, Peoria, Ill.

Railway Club of Greenville.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meetings third Tuesday of each month, except June, July and August.

Railway Club of Pittsburgh.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August, Ft. Pitt Hotel, Pittsburgh, Pa.

Railway Fire Protection Association.—R. R. Hackett. Baltimore & Ohio, Baltimore, Md.

Railway Supply Manufacturers' Association. —J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

St. Louis Railway Club.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

Southern and Southwestern Railway Club.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, July, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

Supply Men's Association. — E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division American Railway Association.

Toronto Railway Club.—J. A. Murphy, 1405 Canadian National Express building, Toronto 2, Ont. Meetings third Monday of each month, except June, July and August.

Traveling Engineers' Association. — W. O. Thompson, 1177 East Ninety-eight street, Cleveland, Ohio.

Western Railway Club.—J. H. Nash, 343 South Dearborn street, Chicago. Regular meetings, third Monday in each month.

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* The mark identifying wheels particularly adapted for modern heavy-duty service.

Two *important* letters in the Railroad Man's alphabet R T

The eighteenth and twentieth letters of the alphabet have taken on a new significance for the railroad man. Stamped on Carnegie Wrought Steel Wheels, the initials "R T" mean Rim-Toughened. They indicate the additional refinement of heat treatment, the process of which produces a wheel with an especially tough rim and with high physical properties . . . a wheel with the extra stamina to endure the stress and strain of modern heavy-duty service. Accurate machining insures perfect rotundity with a consequent increase in riding comfort.

Carnegie special rim-toughened wheels are furnished for passenger, engine truck and tender service. Carnegie Single-Life wheels, rim-toughened, are also available for 70-ton freight service. You already know the outstanding advantages of wrought steel. Learn now of this further improvement. Put your O K on R T wheel specifications and learn how friendly these initials are to your maintenance appropriation. Our wheel engineers will gladly bring you complete details.

CARNEGIE WROUGHT STEEL WHEELS

Product of Carnegie Steel Company, Pittsburgh, Pa. US STEEL *Subsidiary of United States Steel Corporation* 150

NEWS

THE NEW YORK CENTRAL contemplates the construction of an 80-ft. by 170-ft. addition to the enginehouse at its Collinwood yards, Cleveland, Ohio, at an approximate cost of $60,000.

THE ERIE has entered into an agreement with the General American Tank Car Corporation whereby the latter company will furnish refrigerator cars for the entire railroad system; and the General American will also operate the refrigerator cars now owned by the Erie.

ATCHISON, TOPEKA & SANTA FE.—A contract has been let to Fairbanks, Morse & Co., Chicago, for the construction of an automatic electric skip hoist type coaling station, a one-track semi-automatic electric cinder conveyor, and sand storage, drying and handling facilities at Hurley, N. M.

Burlington Shop at Aurora Burned

THE LARGE CONSTRUCTION BUILDING of the coach shops of the Chicago, Burlington & Quincy at Aurora, Ill., was entirely destroyed by fire on September 2, with 27 coaches housed in the structure. The other shops were not touched by the blaze. The shops were opened on August 31, after having been closed for several weeks. The origin of the fire was not discovered.

Salary Reductions

SALARIES of all officers of the Chicago, Rock Island & Pacific, amounting to more than $3,000 a year each, will be cut from five to twenty per cent on October 1. Eighty-five per cent of the employees of the Gulf, Mobile & Northern, those other than train service employees, have voluntarily agreed to a 10 per cent reduction in salaries as long as the railroad is unable to cover interest charges. The Western Pacific has made a horizontal reduction of 10 per cent in the salaries of all employees receiving $300 or more a month.

Air-Conditioned Cars on the Boston & Maine

THE BOSTON & MAINE has placed in test service on its Boston-Portland run a coach equipped with a new method of air cooling and air cleaning which has been found in preliminary tests to provide a temperature 12 to 14 degrees cooler than the outside air. The source of refrigeration is ice, the ice being carried in bunkers beneath the car. Water, cooled by being sprayed over this ice, is circulated by pumps through concealed radiators at either end of the car. The cool air is then drawn across the car ceiling from end to end, thus lowering the temperature gradually and without drafts. The air is dehumidified and filtered by other phases of the process, and the car is kept under a slight positive air pressure which, it is stated, prevents outside dirt and dust from entering, except when doors are opened.

A pre-cooling machine developed by the Boston & Maine, which is much the same as that of the equipment installed in the coach, circulates the water sprayed over ice in radiators to cool the air, the air thus cooled being forced through a canvas duct into the car before being entered by the passengers.

On a day when the temperature outside was 86, the temperature in the air-cooled car was 72 to 74. The pre-cooling on a day when the outside temperature was 89 brought the car temperature ot 75 and was said to have kept the car within a few degrees of this figure for several hours.

In each of these two methods of improving the comfort in passenger equipment—one for its own coaches and one for Pullman cars—the Boston & Maine has had the co-operation of the Metropolitan Ice Company of Boston, Mass., which is engaged in the application and extension of recent air-conditioning developments. The mechanical engineering department of the railroad worked out the details of engineering design, collaborating with the engineers of the Metropolitan Ice Company.

C. P. R. Closes Angus Shops

THE CANADIAN PACIFIC has announced that the Angus shops at Montreal and the Weston yards at Winnipeg will be closed until further notice.

A brief official statement issued by Vice-President Grant Hall announced the indefinite suspension of work on the yards which have been running on short time over a prolonged period. Some 5,000 to 6,000 men are normally employed at the two points, about 3,000 at the Angus shops and between 2,000 and 3,000 at Weston. These men have been on part time for a long period. The company's program of building engines and cars, it is said, has been completed, that portion of the $11,000,000 relief fund ear-marked for production of equipment having been spent.

A further 1100 men have been furloughed from the Ogden shops in Calgary and 400 more from the Coquitlam shops at Vancouver.

Pullman Constructing Enclosed Section Sleeping Cars

THE PULLMAN COMPANY has recently placed in service six sleeping cars which contain sections, comprising lower berths and individual toilet facilities. Two of these cars have been placed in service on the Wabash between Chicago and Detroit, Mich., while four others have been placed in service on the Southern Pacific between San Francisco, Cal., and Portland, Ore. The rate charged for the section, which accommodates one person, is one railroad fare plus a pullman fare of double the price of a lower berth.

The car includes 16 sections, 8 on each side, with a private lavatory for each section. The berth is 30 in. wide, compared with 41 in. in standard sleeping cars. The curtains, which can be opened or closed at will by cords by the occupants, hang several inches from the side of the berth so as to allow roow for dressing and to permit the occupant to enter the lavatory without going into the aisle. The lavatory, located at the end of each section, has a steel door, the frame of which is set at an angle to conserve space. The upper portion of the section is used for storing bedding.

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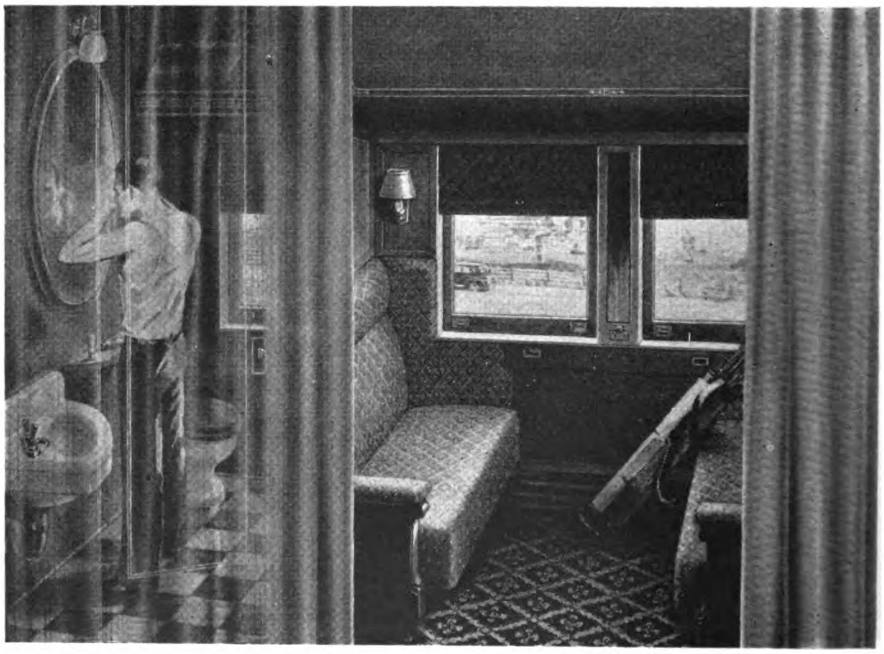

Toilet facilities are provided for each section of this Pullman

Supply Trade Notes

WILLIAM B. ROSS, vice-president in charge of sales of Edwin S. Woods & Co., has been elected president and a member of the board of directors.

N. L. HOWARD, chairman of the board of the North American Car Corporation, has been elected president to succeed Irwin R. Brigham, who becomes less active.

THE INDEPENDENT PNEUMATIC TOOL COMPANY, Chicago, has moved its Birmingham, Ala., office from the Comer building to 915 North Seventh avenue, where it now has warehouse facilities. H. F. Halbert is manager.

HARRY C. BEAVER, vice-president of the Worthington Pump & Machinery Corporation, New York, has been elected president, succeeding LaMonte J. Belnap, who has been elected chairman of the Executive Committee.

LOWELL R. BURCH, chairman of the executive committee of the board of directors of the New York Air Brake Company, New York, has been elected also president of the company. He succeeds B. B. Greer, who has resigned as president and as a director.

THE RAILWAY ENGINEERING EQUIPMENT COMPANY, Chicago, has purchased the Direct Steaming System patents of the Locomotive Terminal Improvement Company. The rights to Canadian patents are vested in the Direct Steaming Company of Canada, Ltd.

THE EASTON CAR & CONSTRUCTION CO., Easton, Pa., has purchased the industrial division of the Lakewood Engineering Company and hereafter the complete line of tier trucks, electric trucks, trailers, skids and industrial cars will be manufactured at Easton, Pa.

THE NATIONAL ACME COMPANY, Cleveland, Ohio, has entered into a licensed agreement with the Dardelet Threadlock Corporation to manufacture, use and sell bolts, nuts, and screw machine products, threaded with the Dardelet self-locking screw thread.

JONATHAN A. NOYES, manager of the Sullivan Machinery Company, with headquarters at Duluth, Minn., has been promoted to manager of the company's coal machinery sales division, with headquarters at Chicago, and has been succeeded by Leon J. Cone, representative, who has been appointed district manager.

HARRISON HOBLITZELLE, executive vice-president of the General Steel Castings Corporation, Eddystone, Pa., has been elected president. Mr. Hoblitzelle was born on October 17, 1896, at St. Louis, Mo., and was graduated from Smith Academy, St. Louis, in 1913, and from Cornell University in 1917, with the degree of A.B. He began work on November 5, 1917, with the Commonwealth

Harrison Hoblitzelle

Steel Company, Granite City, Ill. He was appointed assistant purchasing agent in January, 1919, and manager of purchases and assistant treasurer in December, 1922. He was elected vice-president and manager of purchases in November, 1926, and in January, 1929, became vice-president and manager of sales. Following negotiations, in which he took part, which resulted in the Commonwealth Steel Company becoming a part of the General Steel Castings Corporation, in July, 1929, Mr. Hoblitzelle became vice-president and general manager of the Western, or Commonwealth, division of the latter corporation. On June 1, 1931, he was elected executive vice-president. He is a director of this corporation and of several companies not affiliated with steel industry.

HENRY M. TOCH, chairman of the board of Standard Varnish Works and president of Toch Brothers, Inc., retired from the latter position on September 1, after more than 50 years of active service, but will continue in an advisory capacity as director and chairman of the board of Standard Varnish Works. Dr. Maximilian Toch will succeed H. M. Toch as president of Toch Brothers, Inc., and will also continue as vice-president of Standard Varnish Works.

Domestic Orders Reported During September, 1931

Locomotive

Name of Company	Number Ordered	Type	Builder
Missouri Pacific	1	Gasoline-driven	Plymouth Locomotive Wks.
Total for month	1		

Freight Cars

Name of Company	Number Ordered	Type	Builder
United States Navy Department	1	Flat	Koppel Industrial Car & Equipment Co.
	1	Helium compressor	J. G. Brill Co.
E. I du Pont de Nemours & Co.	1	Tank	General American Tank Car Corp.
Total for month	3		

R. C. TODD, assistant general sales manager of the American Rolling Mill Company, Middletown, Ohio, has been promoted to assistant vice-president and will engage in special work in connection with the company's sales activities. H. M. Richards, manager of the Cleveland sales district, with headquarters at Cleveland, has been appointed assistant general manager of sales to succeed Mr. Todd, while Foster E. Wortley, assistant district manager of the Pittsburgh office, succeeds Mr. Richards. O. L. Conley has been appointed assistant manager of the Cleveland district.

GEORGE W. WILDIN, Pittsburgh, Pa., representative of The Cardwell Westinghouse Company, severed his connection with that organization on August 1 and will open an office at 207 Westinghouse building, Pittsburgh. He will retain his connection with the Westinghouse Air Brake Company in the capacity of consulting engineer. In his new field of endeavor, Mr. Wildin plans to take up the work of railway and industrial engineer-

George W. Wildin

ing and also his organization will act as representative for supply concerns having devices of interest to the railway and industrial fields. Mr. Wildin entered the railway field direct from college. He served consecutively as mechanical draftsman, engineer of tests, freight car repairman, machinist, locomotive fireman, locomotive engineman, general locomotive and car inspector, mechanical engineer, assistant mechanical superintendent, mechanical superintendent, general mechanical superintendent and general manager, with experience on eight railroads in different parts of the United States and Mexico, covering a period of 26 years. His industrial experience covers a period of eight years as general manager of The Westinghouse Air Brake Company, in charge of production, engineering and tests, and five years in the sales department of The Westinghouse Friction Draft Gear Company and The Cardwell Westinghouse Company. Mr. Wildin is affiliated with several engineering and railway organizations; he is a past president of the American Railway Association, Mechanical Division, also of the New York Railroad Club and the Railway Club of Pittsburgh.

(Continued on next left-hand page)

Charles H. Gayetty has been appointed manager of railway sales of Keasbey & Mattison Company, Ambler, Pa.

The general headquarters of Safety Refrigeration, Inc., will be moved on October 1 from New York to the Railway Exchange building, 80 East Jackson boulevard, Chicago. This will include the offices of Horace M. Wigney, manager, now located at 75 West street, New York, and J. H. Michaeli, superintendent of transportation, now located at New Haven, Conn.

Obituary

Van Ness DeLamater, of the Hyatt Roller Bearing Company, Newark, N. J., and his son, 23 years old, who were vacationing in the Canadian woods, have been missing since August 29, when they started from a camp on an island in Green Lake, Algonquin National Park, Ontario, on a canoe-trip. A search was instituted, but without success. An upturned canoe found on the shore, and information that a freakish storm struck the lake while the men were presumably on it, precluded the possibility that they might be lost in the woods. Mr. DeLamater had been associated with the Hyatt Roller Bearing Company since 1915, first as a member of the motor bearings division in Detroit, and for the past several years as sales engineer located at the plant office in Newark, specializing in railroad bearing applications.

Alva Clymer Dinkey president of the Midvale Company, Nicetown, Pa., and for many years a leader in the steel industry, who died of heart disease at his home at Wynnewood, on August 11, was born on February 20, 1866, at Weatherly,

A. C. Dinkey

Pa. Mr. Dinkey began his service as a water boy at the Edgar Thomson Steel Works in May, 1879. He subsequently served as telegraph operator at the same works and in 1885 as machinist at the Pittsburgh Locomotive Works, Allegheny, Pa. Three years later he went as expert machinist to the McTighe Electric Company, Pittsburgh. He was then appointed secretary to the general superintendent of the Homestead Works of the Carnegie Steel Company, serving in that position until he was appointed electrical engineer of the works in 1893. From 1901 to 1903 he was general superintendent of the Homestead Works. He was elected president of the Carnegie Steel Company in 1903 and in 1915 resigned to become president of the Midvale Steel & Ordnance Company. He later became president of the Midvale Company. Mr. Dinkey, in addition to being a director of the American Iron & Steel Institute, was a member of a number of technical societies and was also interested in several banks and industrial organizations.

Thomas H. Symington, of Baltimore, Md., well-known mechanical engineer; founder of the railway supply firm, the T. H. Symington Company, and, at the time of his death, chairman of T. H. Symington & Son, Inc., died suddenly on Saturday, September 19, at the Hospital for the Ruptured and Crippled in New York. Mr. Symington was born at Baltimore, Md., on May 14, 1869, and received his early education in the public schools of that city. He entered railroad service in 1887, with the Baltimore & Ohio, serving for four years as a machinist apprentice in that company's shops. In 1891, after finishing night courses at the Mechanics Institute, he entered Lehigh University, at Bethlehem, Pa., where he completed a four-year course in two years, and also took an active part in athletics

T. H. Symington

and other college activities. Upon being graduated from Lehigh in 1893, with a degree in mechanical engineering, Mr. Symington entered the employ of the Richmond Locomotive Works, where he was promoted through various positions from draftsman to that of superintendent of shops. In 1898 he severed his connection with the Richmond Locomotive Works to become superintendent of motive power of the Atlantic Coast Line, which position he held until 1901.

Since that year, when he gave up actual railway work to organize his own manufacturing concern, Mr. Symington had been prominent in the railway supply field, serving first as president and later as chairman of the T. H. Symington Company, founded by him in 1901 and incorporated in 1906. When, however, that company was succeeded by the present Symington Company, in December, 1924, Mr. Symington disposed of his interests therein, and subsequently organized the firm of T. H. Symington & Son, Inc., with offices at Baltimore. His work with the latter company, of which he was chairman at the time of his death, consisted largely of research work on cast-steel truck side frames for freight cars and freight car dynamics in general. As a result of his research work, Mr. Symington developed a number of inventions of his own. He was also the author of several papers on freight car performance presented before the American Society of Mechanical Engineers and other railroad and engineering societies.

During the war Mr. Symington owned and operated six large companies in Rochester, N. Y., and Chicago, for the production of war material, including special machinery, forgings, ordnance and artillery ammunition. Toward the close of the war, he was appointed chief of ordnance in charge of the entire United States artillery ammunition program.

Clemuel Ricketts Woodin, director and member of the executive committee of the American Car & Foundry Company, of which company his son, William Hartman Woodin, is president, died at his home at Berwick, Pa., on September 25. C. R. Woodin was born on December 26, 1844, at Cambra, Luzerne County, Pa. He attended Kingston (Pa.) seminary until he was 16 years of age, when he entered the employ of Jackson & Woodin at Berwick, of which firm his father was a partner. Since entering that service, Mr. Woodin has been continuously connected with the railway equipment industry, except for a period of military service during the Civil war, as a member of Company C, 28th Regiment, Pennsylvania Emergency Reserves. He was a pioneer in the railway equipment industry and a contemporary of Commodore Vanderbilt of the New York Central, Samuel Sloane of the Lackawanna and many others prominent in developing the large railway systems of the country. The firm of Jackson & Woodin, with which he began work, was first engaged in the manufacture of plows, stoves, iron pipe and other foundry products. In 1861 the business was extended to include the building of small cars for use in limestone quarries and later of railroad cars and mine cars. By 1869 the firm was established as an important member of the railway supply industry. In 1872 the Jackson & Woodin Manufacturing Company was organized, with C. R. Woodin as president, which position he held for 20 years until he retired from active service on account of ill health. In 1899, when the American Car & Foundry Company was formed, the Jackson & Woodin Manufacturing Company was absorbed in the consolidation. Shortly thereafter, Mr. Woodin was elected to its board of directors, and in 1906 was chosen a member of its executive committee, which offices he held at the time of his death. He was also a director of the American Car & Foundry Securities Corporation.

Personal Mention

General

W. H. FLYNN, general superintendent of motive power and rolling stock of the New York Central, has been appointed also to the same position on the Michigan Central, with headquarters as before at New York.

J. W. BURNETT, assistant general superintendent of motive power and machinery of the Union Pacific at Omaha, has been appointed assistant general superintendent of motive power and machinery with headquarters at Pocatello, Idaho. Mr. Burnett began railroading when a boy of 15 and entered Union Pacific service as a machinist at Cheyenne in 1912. A year later he was a foreman and advanced through the mechanical department to assistant general superintendent of motive power and machinery at Omaha on October 1, 1930, with jurisdiction over the Union Pacific and the St. Joseph and Grand Island.

E. J. COLE, assistant to the general superintendent of the Union Pacific at Omaha, Neb., has been promoted to the position of assistant general superintendent of motive power and machinery at Omaha. Mr. Cole, a native of Cheyenne, Wyo., became a machinist apprentice at the shops there in 1908. He subsequently served as machinist, machine inspector, erecting gang foreman and district foreman, and, in 1923, became superintendent of the Cheyenne shops. Two years later he was transferred to Omaha as superintendent of shops and, on January 1, 1929, was appointed assistant to the general superintendent of motive power and machinery. During the war Mr. Cole was a chief machinist and mate in the United States navy.

J. W. HIGHLEYMAN, assistant general superintendent of motive power and machinery of the Union Pacific System at Pocatello, Idaho, has been promoted to general superintendent of motive power and machinery, with headquarters at Omaha, Neb. Mr. Highleyman, a native of West Virginia, began his railroad career as a machinist at Sedalia, Mo., and entered Union Pacific service at Armstrong, Kan., in 1893. His advancement to foreman two years later started his upward climb. During the war he served in the mechanical department of the A. E. F. in France and at his discharge he had been advanced to major. After the war he returned to Union Pacific service in the motive power and machinery department and, on October 1, 1930, was appointed assistant general superintendent of the department with headquarters at Pocatello and with jurisdiction over the Oregon Short Line, the Oregon-Washington, and the Los Angeles and Salt Lake railroads, the intermountain, northwestern and southeastern units respectively of the Union Pacific.

Master Mechanics and Road Foremen

S. C. GRAHAM, master mechanic of the Chicago & North Western, with headquarters at Missouri Valley, Iowa, retired on September 1, with a record of nearly 50 years of service with that road.

G. S. KING, master mechanic of the Dakota division of the Chicago & North Western, has been appointed assistant master mechanic of that division, excepting the territory west of Pierre, with headquarters as before at Huron, S. D.

J. W. ANDERSON, master mechanic of the Minnesota division of the Chicago & North Western, which has recently been combined with the Madison and Dakota divisions, has been appointed master mechanic of the Dakota division (except from Pierre to Rapid City), with headquarters at Winona, Minn. Mr. Anderson also has jurisdiction over the Winona shops and the Madison division from Winona to Waseca, Minn.

W. H. HALSEY, master mechanic of the Iowa division of the Chicago & North Western, at Boone, Iowa, has been appointed master mechanic of the Western Lines, with headquarters at Chadron, Neb., where he will have jurisdiction over the Eastern Black Hills, and Wyoming divisions and that part of the Dakota division between Pierre, S. D., and Rapid City.

E. F. STROEH, master mechanic of the Missouri division of the Missouri Pacific, with headquarters at Poplar Bluff, Mo., has had his jurisdiction extended to include the Missouri-Illinois, a unit of the Missouri Pacific. The position of master mechanic of the Missouri-Illinois which was held by R. Kling at Bonne Terre, Mo., has been abolished.

Car Department

THE POSITION OF superintendent car department of the Central of New Jersey has been abolished, and John Clark, who served in that capacity, has been appointed general foreman freight car shop, with headquarters at Ashley, Pa.

J. S. WILSON, superintendent of shops for the Michigan Central, has been appointed general foreman in charge of the West Detroit (Mich.) car shops, with headquarters as before at West Detroit, following the abolition of the position of superintendent of shops.

Shop and Enginehouse

THE DUTIES of master mechanic of the Central of Georgia formerly handled by S. A. Whitehurst, deceased, have been assumed by R. M. Culver, general foreman at Savannah, Ga., the position of master mechanic having been abolished. It was incorrectly stated in the September issue of the *Railway Mechanical Engineer* that Mr. Culver had been appointed master mechanic succeeding Mr. Whitehurst.

W. T. CURLEE, enginehouse foreman of the Southern at Spencer, N. C., has been promoted to the position of assistant day enginehouse foreman.

J. M. FRICK, general foreman of the Southern at Greensboro, N. C., has been promoted to the position of general enginehouse foreman, at Spencer, N. C.

Obituary

O. S. JACKSON, general superintendent of motive power and machinery of the Union Pacific System, with headquarters at Omaha, Neb., died on September 26 at the Fontenelle Hotel in that city. Mr. Jackson was a man of broad experience in the railway mechanical field, having had about 34 years' service in the mechanical departments of various roads.

O. S. Jackson

He was born near Huntingdon, Ind., in 1875, and at the age of 14 years entered railway service as a water boy on a railroad that is now a part of the Cleveland, Cincinnati, Chicago & St. Louis. After a short term of service with the Big Four and then with the Erie, Mr. Jackson reentered the mechanical department of the former road in 1897 and served in various positions until 1905, at which time he was appointed general foreman on the Chicago, Indianapolis & Louisville. Four years later he was promoted to master mechanic at Lafayette, Ind., and in 1913, he was appointed superintendent of motive power of the Chicago, Terre Haute & Southeastern (now a part of the Chicago, Milwaukee, St. Paul & Pacific). A year later, Mr. Jackson was promoted to general superintendent in charge of both the mechanical and transportation departments, with headquarters as before at Terre Haute, Ind. He entered the service of the Union Pacific in September, 1921, as assistant superintendent of motive power and machinery, with headquarters at Omaha, and was promoted to superintendent of motive power and machinery in June, 1923. Mr. Jackson's further promotion to general superintendent of motive power and machinery of the Union Pacific System took place late in 1928.

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November - 1931

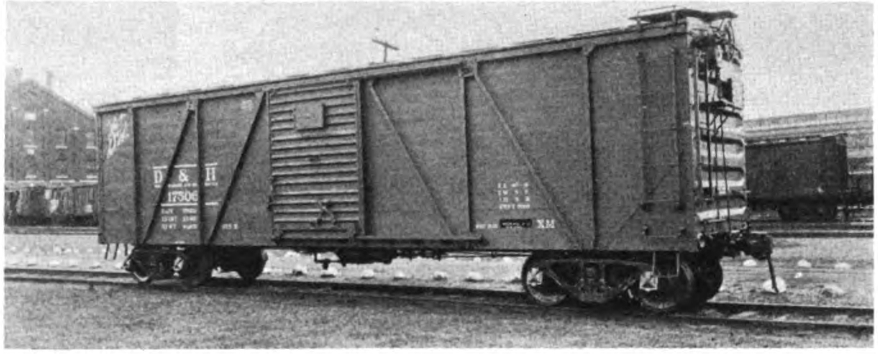
D. & H. Builds 100 Box Cars

Constructed at Green Island Shops according to plan known as the "Point System"—Eight-station spot system arranged to produce one complete car each day — Single-sheathed, steel-frame box cars of 80,000 lb. capacity

THE Delaware & Hudson recently placed in service 100 single-sheathed steel-frame box cars having a capacity of 80,000 lb. These cars are 40 ft. long and have a load limit of 91,400 lb. and a tare weight of 44,600 lb. These new cars replaced the same number of obsolete units which were retired.

The new cars, which were built at the Green Island (N. Y.) shops, are being used largely for the transportation of lading such as paper and paper products, flour, feed, grain, etc. They are also intended for furniture, refrigerators, ground slate, cement, lime and similar commodities.

The construction of the cars was carried out according to a plan which has been developed by the car department and known as the "point system." The actual work was handled through the shops of an eight station spot system, the production schedule of which was arranged for one complete car each eight-hour day. The assembling and constructing operations, exclusive of the air-brake work, were performed by a force of 20 car mechanics, which included 13-steel car and 7 wood-car men.



Single-sheathed 80,000-lb. box car built by the Delaware & Hudson

The Point System

Under the point system an equal number of cars of similar type and purpose are retired as a new building program progresses. Thus, the retirement of obsolete units is carried out systematically, insuring the selection of cars which have passed the stage where they can be repaired economically.

The functioning of the point system keeps in effect a definite method for determining the disposition of freight cars in need of extensive repairs. For example, the major items of repair, except trucks and draft gears, common to cars of a certain class and series are listed, and the cost of labor and material for repairing the various parts is determined.

The cost, thus estimated and determined, is reduced to points, each point representing a definite amount of money. Each major repair item is assigned a certain number of points. A maximum number of points is then established, which figure determines the disposition of each car of the series.

A statement showing the condition of each car scheduled for demolition is submitted by the division car foreman to the master car builder. This statement includes each major item of repair, shows the condition of the part and whether or not it should be renewed. Authority for disposition is only sought when the extent of reconditioning a car indicates that the authorized

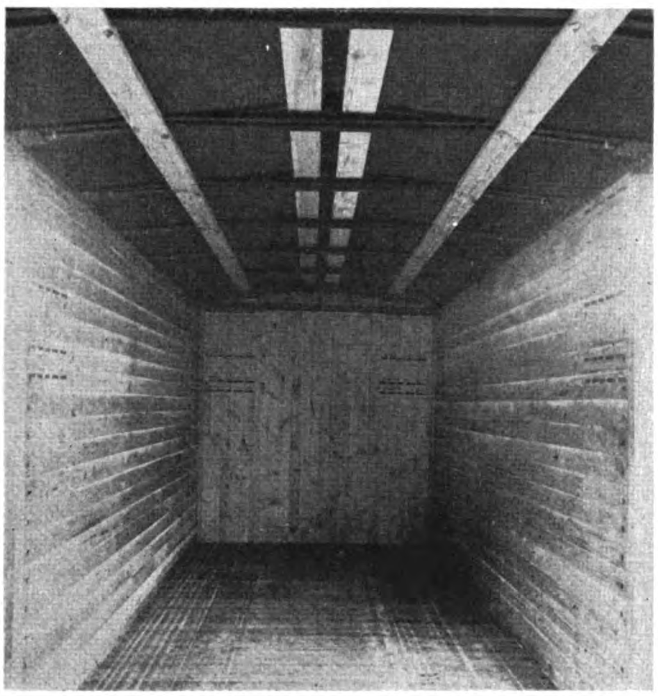
limit of points will be exceeded when repairs are made.

Once a number of points for repairing freight cars of a particular series is established, the allowable limit of points remains constant and is not susceptible to revision because of fluctuating material prices and labor rates, as is the case when monetary limits are employed.

Construction of the Cars

In the steel construction of the new box cars are 225 fabricated steel parts of various shapes, the assembling of which involved the driving of 1,934 rivets. The shapes were fabricated at the steel mills in accordance with D. & H. drawings and specifications.

The center sills are made up of two 12-in., 40.3 lb., A.R.A. sections, with one 1/4-in. by 20-in. top cover plate, while the side sills consist of 7-in., 18.8-lb., ARA sections. The body bolsters are composed of 3/8-in. pressed diaphragms with 3/8-in. by 22-in. top., and 1/2-in. by 18-in. bottom cover plates, while the cross-bearers have 5/16-



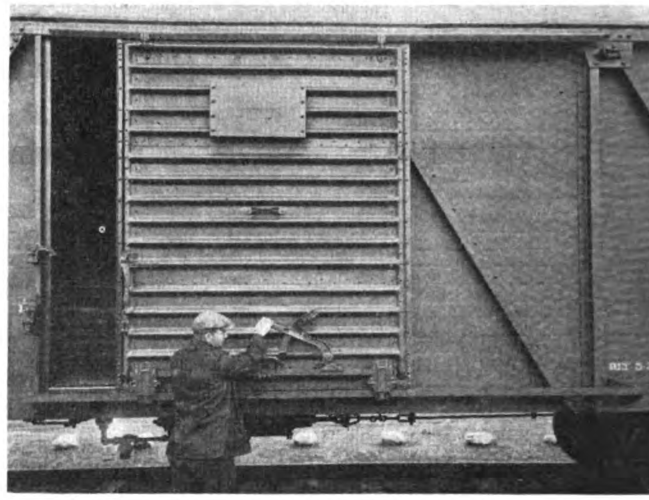
Interior of one of the new D. & H. box cars

in. diaphragms and 3/8-in. by 8-in. top, and 3/8-in. by 6-in. bottom cover plates with a 3-in. by 3-in. by 1/4-in. stiffener angle at the top cover plate. Cross-tie webs consist of 1/4-in. steel diaphragms.

The wood construction (siding, decking, posts, etc.) required the use of 991 bolts. Practically all of these bolts have specially formed countersunk heads, thus sealing the holes and making them water tight. The absence of nails and the use of this type of bolt head, which is drawn flush with the wood, minimizes the possibility of damage to lading often occasioned by protruding nails, bolts, etc.

The trucks were designed and built by the National Malleable & Steel Castings Company and are known as the type B. The major objectives sought in this design are greater flexibility, better riding qualities, and increased clearance above the track.

This truck is a departure from the conventional A.R.A. type in that the spring plan is entirely eliminated. The spring arrangement consists of A.R.A. type E truck springs with two in the bolster end and two underneath in the side frame. The brake-hanger brackets and journal boxes are cast integral with the side

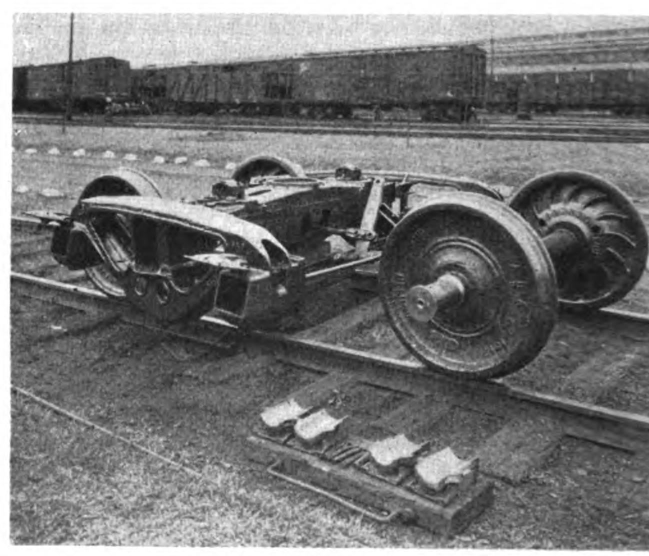


Youngstown steel door with Camel fixtures

frame. Because of the quick-wheel change feature, it is possible for two men to change a pair of wheels in less than one-half hour. All the brake rigging is above the beams, consequently there is less liability of a brake beam pulling off in case of a derailment or accident. Maintenance is further reduced by the absence of bolts commonly used in the conventional design of truck.

The draft attachments used are a complete assembly of the Miner A-22XB friction draft gear in conjunction with the American radial Type D coupler and vertical-key yoke, which is interchangeable with any A.R.A. standard Type D coupler and cast-steel yoke, the center sills being slotted to accommodate a horizontal key.

In this draft attachment constant bearing areas are maintained, irrespective of angularity, in transmitting heavy loads from the coupler to the draft gear, and from the draft gear to the center sills through substantial draft lugs. The function of the radial coupler is ma-



National Type B truck—Designed to expedite the changing of wheels

terially to reduce maintenance on draft riggings.

The side door applied is designed to eliminate the trouble frequently experienced with doors jamming and necessitating the use of bars to move them, usually with destructive results. The type of door on the new box

(Continued on page 538)

Rebuilt 4-6-2 Compound Locomotives Show Economies

Orleans System of France by modifying the steam passages and its distribution, increasing the superheat and applying Thermic syphons to 20 Pacific type compound locomotives, obtains 50 per cent more horsepower available at the tender drawbar

IN an article which appeared in the July, 1931, issue of the Revue Generale des Chemins de Fer, M. Andrew Chapelon, division inspector for the Orleans Company, France, described the results of an elaborate series of comparative dynamometer tests which the railroad made with a 4-6-2 type compound locomotive, No. 3566, which had been changed by the application of a Nicholson Thermic syphon and two exhaust nozzles in connection with a double stack, enlarging the superheater and applying Lentz poppet valves of the oscillating cam design actuated by a Walschaert gear. Originally steam distribution to the high-pressure cylinders of this locomotive was effected by piston valves and by flat slide valves to the low-pressure cylinders.

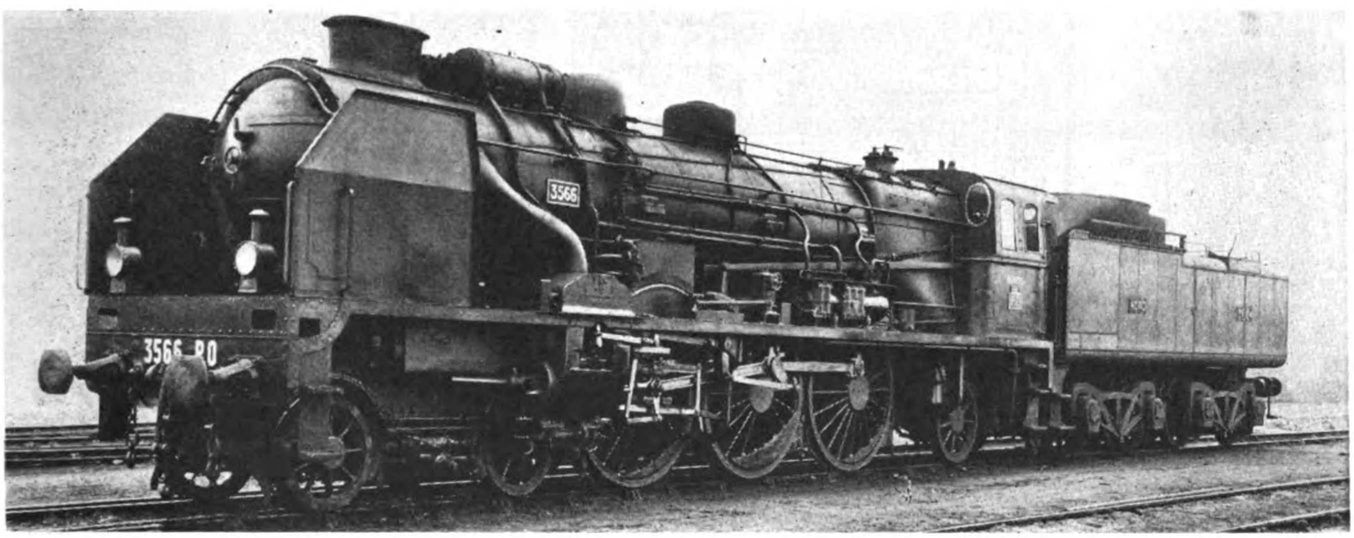
As a result of these tests with locomotive No. 3566, the Orleans Company, formerly the Paris-Orleans Railway, is rebuilding twenty of its 4-6-2 type compound locomotives which were originally built in 1909 by the Societe Alsacienne de Constructions Mecaniques for express-passenger service. The rebuilt power is scheduled for delivery in 1932. As originally built, these locomotives performed satisfactory service, but the continued increase in tonnage to be hauled at high speeds made it necessary to operate them at maximum capacity, with little margin to meet unforeseen delays to schedules.

Locomotive No. 3566 was rebuilt at the Tours shops of the railroad. The tests showed an increase of 50 per cent in hauling capacity at the tender drawbar, a decrease of from 10 to 25 per cent in water consumption, a coal consumption of 2.7 lb. per drawbar hp.hr., and the ability to haul the required tonnage at increased sustained speeds.

Monsieur Chapelon, in his article, reviewed the development of the 4-6-2 type compound locomotives from the time this type was first placed in service on the Paris-Orleans in 1909. The development of this type of power was supplemented by extensive dynamometer road tests, the first 4-6-2 type compound locomotives being compared with the performance of 4-4-2 and 4-6-0 type compound locomotives with flat slide valves which were formerly used for express passenger service. The principal result of the early series of comparative road tests with 4-4-2 and 4-6-0 type locomotives with a design of 4-6-2 types built in 1909 and 1910 resulted in the procuring of 39 locomotives, series Nos. 3551 to 3589, inclusive. These locomotives which were of the 4-6-2 compound type, were placed in service during 1912 to 1914. They were constructed with slightly modified high-pressure cylinders and with a valve motion, the events of which presented more regularity.

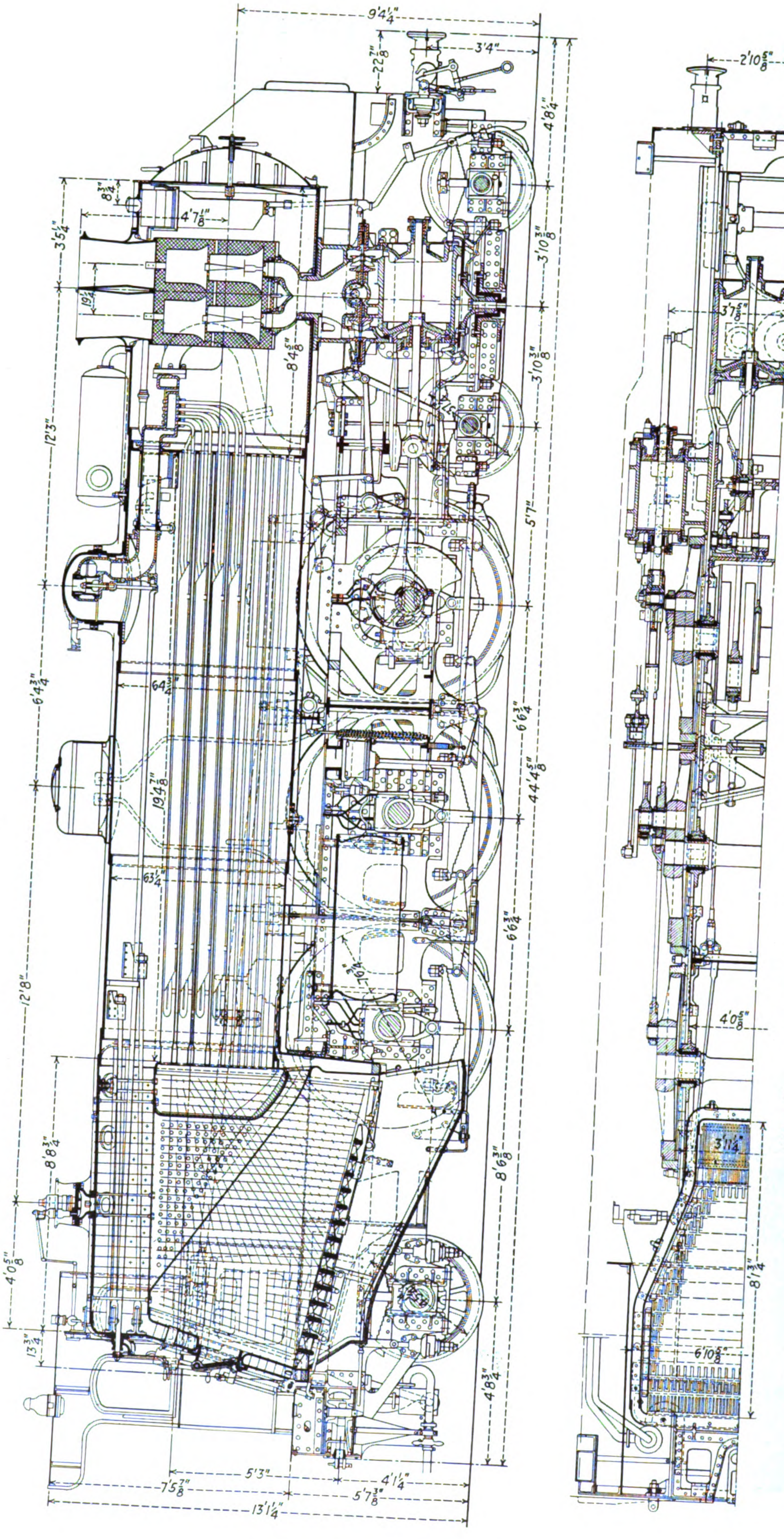
The diameter of the piston valves had been increased from 9.84 to 10.63 in. The maximum section of port opening was increased from 30.64 to 34.9 sq. in. The clearance which also had appeared too small in the first locomotives was increased from 11.5 per cent to 13.2 per cent. Finally, the high-pressure cylinders were provided with a by-pass.

The 4-6-2 type locomotives of these different series rendered good service. They are still hauling the larger part of the heavily loaded trains which are oper-



Courtesy Revue Generale des Chemins de Fer

Orleans rebuilt 4-6-2 type compound locomotive No. 3566



Elevation and plan of the rebuilt Orleans 4-6-2 type compound locomotive No. 3566

ated at high speed over the principal divisions of the system.

Modern Operating Requirements Created New Problems

However, it appeared necessary during the years following the war to improve the performance of these locomotives, especially with a view to enabling them to maintain the highest speeds, 71½ to 74½ m.p.h., under satisfactory conditions of economy.

A trial of double-admission valves of the Allen or "trick" type, applied to the high-pressure cylinders (piston valves) and to the low-pressure cylinders (flat slide valves) was made in 1923 on engine No. 3584.

Comparison of the dimensions, weights and proportions of the Orleans rebuilt 4-6-2 type compound locomotives

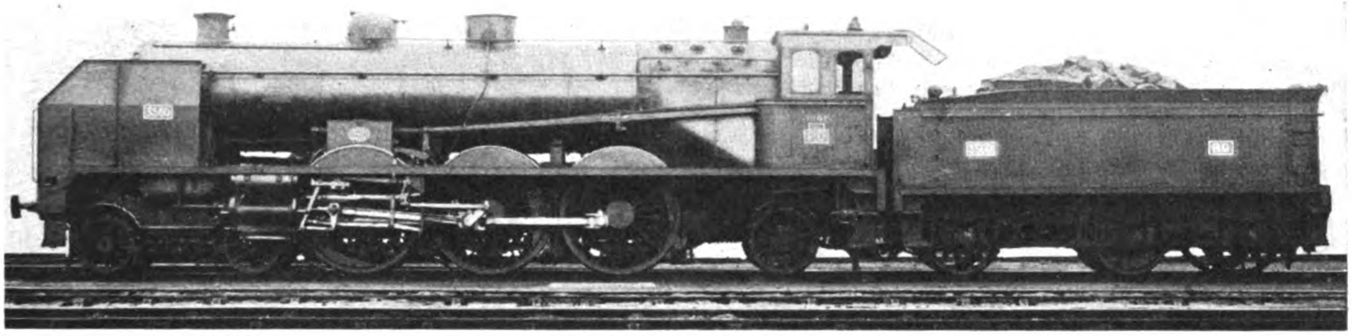
Railroad	Orleans Company	
Builder	Societe Alsacienne de Constructions Mecaniques	
Built	1912	1912
Rebuilt	....	1929 (Co. shops)
Road numbers	3551-3589	3566
Type of locomotive	4-6-2	
Service	Passenger	Experimental
Cylinders, diameter and stroke	2 H.P.—16.5 in. by 25.6 in. 2 L.P.—25.2 in. by 25.6 in.	
Valve gear, type	Walschaert	Lentz horizontal valves, Walschaert motion
Valves, piston type, size	10.6 in. H.P.	....
Maximum travel	5.1 in. H.P. 5.7 in. L.P.	....
Steam lap	2.12 in.	....
Exhaust clearance	.236 in. H.P. .394 in. L.P.	....
Cut-off in full gear, per cent	78.5 H.P. 80.0 L.P.	....
Valves, oscillating-cam type:		
Admission valves, diameter	....	7.26 in. H.P. 8.65 in. L.P.
Exhaust valves, diameter	....	7.66 in. H.P. 9.44 in. L.P.
Maximum stroke, admission valves	....	.962 in. H.P. 1.12 in. L.P.
Maximum stroke, exhaust valves	....	.944 in. H.P. 1.10 in. L.P.
Steam lap, one quarter stroke	....	15 deg.
Exhaust opening	....	6 deg. H.P. 7 deg. L.P.
Cut-off, per cent	....	79.5 H.P. 82.0 L.P.
Weights in working order:		
On drivers	116,800 lb.	125,662 lb.
On front truck	51,200 lb.	55,335 lb.
On trailing truck	36,750 lb.	37,800 lb.
Total engine	204,750 lb.	218,797 lb.
Wheel bases:		
Driving	13 ft. 1½ in.	
Total engine	34 ft. 11⅜ in.	
Wheels, diameter outside tires:		
Driving	76¾ in.	
Front truck	37¾ in.	
Trailing truck	45¼ in.	
Boiler:		
Type	Straight top	
Steam pressure	227.57 lb.	
Fuel, kind	Soft coal (Briquettes)	
Diameter, first ring, inside	64¼ in.	
Firebox, length	110½ in.	
Firebox, width, front	39 in.	
Firebox, width, rear	71¼ in.	
Tubes, number and diameter	151—2 in.	80—2 in.
Flues, number and diameter	24—5 in.	40—5 in.
Length over tube nue sheets	19 ft. 4⅞ in.	
Grate area	45.96 sq. ft.	
Heating surfaces:		
Firebox and arch tubes	165.45 sq. ft.	164.1 sq. ft.
Thermic syphon	....	26.5 sq. ft.
Tubes and flues	2,163.3 sq. ft.	1,787.64 sq. ft.
Total evaporative	2,328.75 sq. ft.	1,978.24 sq. ft.
Superheating	678.69 sq. ft.	784.18 sq. ft.
Combined evaporative and superheat.	3,007.44 sq. ft.	2,762.42 sq. ft.
General data:		
Max. rated tractive force, estimated	35,650 lb.	38,770 lb.
Cyl. hp. at 62¾ m.p.h., test	1,923 hp.	2,710 hp.
Weight proportions:		
Weight on drivers ÷ total weight engine, per cent	57	57.4
Weight on drivers ÷ tractive force	3.27	3.25
Total weight engine ÷ comb. heat. surface	68.2	79.2
Boiler proportions:		
Tractive force ÷ comb. heat. surface	11.88	14.0
Tractive force × dia. drivers ÷ comb. heat. surface	912	1,075
Firebox heat. surface ÷ grate area	3.61	4.14
Firebox heat. surface, per cent, evap. heat. surface	7.1	9.63
Superheat. surface, per cent, evap. heat. surface	29.4	39.6
Comb. heat. surface ÷ grate area	65.5	60.4

The experiments made on this locomotive showed that the cut-offs both for the high-pressure cylinders and the low-pressure cylinders could be substantially reduced with this type of slide valve without the tractive force being diminished. On the contrary, the maximum power of the engine remained substantially the same. The maximum speed attained was practically the same as that of other locomotives of similar design, but without the change in valve design.

The good effects produced through reduced throttling at the admission, due to the double-admission orifices of the valves, were lost at heavy admissions and at high speeds through the exhaust back pressures which remained equal, with the same expenditure of steam, to what they were with the valves previously employed.

In 1925 the results obtained in Austria with the Lentz valve motion with horizontal valves* appeared to furnish a solution of the problem. It was decided to apply this gear to two engines of the 3500 series.

Dynamometer tests made on one of these locomotives showed that no improvement had been made through the



Courtesy Revue Generale des Chemins de Fer

One of the same series of locomotives as the No. 3566 previous to rebuilding

substitution of the Lentz valves. A study of the question, which was undertaken without awaiting the results of these tests, led to the conclusion that any improvement in the performance of the No. 3500 series could not be fully obtained except by changing the valve motion and the steam passages at the same time.

An examination of indicator diagrams taken in 1911 on engine No. 3545 showed considerable loss as the steam passed from the boiler to the high-pressure cylinders, thence to the low-pressure cylinders, and to the atmosphere.

An analysis of different studies of the problem made

* For a description of this gear see the *Railway Mechanical Engineer*, July, 1924, page 407.

it apparent that, to obtain maximum performance from the compound engines, it was necessary to conform strictly to the following conditions: (1) To provide compound engines with steam passages allowing only minimum loss from the boiler through the high- and low-pressure cylinders to the atmosphere, the passages to consist of pipes of large diameter and arranged as directly as possible; (2) to provide compound locomotives with large admission ports and clearances sufficient to avoid throttling and exaggerated compressions in the cylinders; (3) to provide large steam chests to avoid heavy fluctuations of pressure which are produced when the volume is insufficient; (4) to preserve the independence of the high-pressure and the low-pressure valve motions to obtain, for each condition of running, the best combination of the two.

Measurement of the temperatures of the steam had shown that the degree of superheat in the low-pressure cylinders was practically nil (18 to 36 deg. F.). It seemed opportune to have not only the high-pressure cylinders of the engine, but also its low-pressure cylinders, benefit from the advantages of superheating. It seemed desirable to push the superheat much further than what had been done up to that time on the locomotives under consideration—from 554 to 572 deg. F. It seemed opportune, with due consideration for the behavior of the lubricants and of the castings, to approach as near as possible to 752 deg. F. It was decided to apply these two principles to the second engine of the No. 3500 series which was to be equipped for steam distribution by means of Lentz valves.

A number of supplementary modifications also became necessary to make it possible to obtain the greatest possible advantage from these two fundamental principles.

The search for the maximum efficiency in the action of the steam led to the design, as a natural complement, of steam passages of large dimensions and of correct outline, and an exhaust involving only a minimum of back pressure on the pistons.

It was therefore decided to apply an exhaust nozzle of the K. C. or Kylchap type, the installation of which on 4-6-2 type locomotive No. 4500 had just been completed and which, from the viewpoint of intensive draft, low back pressure and efficiency of combustion on the grates, had given results which were clearly superior to those obtained with other types of exhaust nozzles.

It was desirable to increase the sectional area for the passage of the gases through the stack. A single stack of large diameter would give only mediocre results because of its relatively low height. Therefore, a double exhaust nozzle of the K. C. type was applied.

The large proportions necessary for the superheater to supply the cylinders with steam at a temperature of 752 deg. F. gave occasion to fear a harmful lowering of the thermal output of the boiler because of the relatively small efficiency of the superheating surfaces. As shown in one of the tables, the rebuilt locomotive, No. 3566, has a superheating surface of 784.18 sq. ft. This would, of necessity, have to be of larger area. It was, therefore, necessary to seek to increase the evaporation performance of the boiler on the trial locomotive in other respects.

As limitations were imposed by the general dimensions of the locomotive which had to be retained, it was decided to install a Nicholson thermic syphon.

The desire to reduce by all means possible the consumption of water and of fuel led to equipping the rebuilt locomotive, as well as all locomotives of recent construction with feedwater heaters. Finally, the necessity of being able to maintain the greatest speeds without limitations of a mechanical nature led to the adoption of a cranked axle with balanced cranks and of lighter connecting rods for the low-pressure cylinders, as well as force-feed lubrication of the driving boxes.

Description of the Rebuilt Locomotive

The first locomotive rebuilt was No. 3566 which was originally constructed in 1912 by the Alsac Mechanical Construction Company, Belfort, Alsace, France. It was rebuilt in 1929 in the shops of the company and was returned to service in November of that year.

The principal modifications made to this locomotive can be summarized as follows:

1—Replacing various pipes and devices forming part of the steam passages and securing a substantial increase in the size of the passages.

2—Replacement of the valve motions; namely, the piston valves for the high-pressure cylinders, and the flat slide valves for the low-pressure cylinders by double-seating Lentz valves, controlled by oscillating cam shafts and Walschaert motion.

3—Replacement of the Schmidt superheater of 24 elements with a Robinson superheater with 32 elements.

4—The addition of a Nicholson thermic syphon in the center of the firebox. (Arch tubes are used at either side.)

5—Replacement of the variable exhaust nozzles by a double Kylchap exhaust of a fixed type. This nozzle arrangement required two stacks placed in parallel, as shown in one of the drawings.

6—The application of an A.C.F.I. integral type feedwater heater manufactured by L'Auxiliare des Chemins de Fer et de l'Industrie, Paris.

A certain number of complementary modifications became necessary through the novel operating conditions imposed on the locomotive, such as a crank axle with balanced cranks and mechanical lubrication of the driving boxes.

The temperature adopted for the superheater made it necessary to devise a special system of lubrication for the cylinders. Thus, the condensation lubricator ordinarily used was replaced by a mechanical lubricator.

Superheater and Feedwater Heater

The superheater has 32 Robinson elements, each of which is comprised of four steel tubes 1½ in. in outside diameter. Each element of four tubes is located in one of the flues which are 5 in. in outside diameter. These elements differ from the Schmidt elements in that the return tube toward the smokebox stops at about two-thirds of the distance from the back to the front flue sheet.

The shortest distance from the Robinson superheater loops to the back tube sheet is 11.8 in. as compared to 23.62 in. for the Schmidt elements applied previous to rebuilding.

The feeding of the boiler is effected by means of a non-lifting injector of the Friedmann S. Z. type, No. 10, and by the A. C. F. I. feedwater heater. This heater uses exhaust steam for preheating the water to a temperature above 212 deg. F.

The diameter of the steam cylinder of the pump is 10 in. The diameter of the water cylinders is 8 in. and the stroke of the pistons, 10¼ in. The theoretical maximum hourly output is 5,160 gal. at a speed of 45 strokes per minute.

Cylinders and Steam Distribution

The high-pressure cylinders are provided with automatic by-pass valves of special steel which place the front face of each piston in communication with the rear face when running with closed throttle. The low-pressure cylinders are provided with drifting valves.

Locomotive No. 3566 was also equipped with an intercepting valve which made it possible to isolate the

high-pressure cylinders from the low-pressure cylinders when desired. The main rods from the low-pressure cylinders are of hollow design and heat treated.

The valve motions are independent to permit the engineman to use, as occasion arises, the combination of high-pressure and low-pressure cut-offs considered to be most suitable.

Each high-pressure and low-pressure cylinder has two admission valves and two exhaust valves; that is, one admission valve and one exhaust valve for each end of the cylinder. These valves are of the Lentz double-seat type with horizontal movement and are located over the cylinders. Opening of the valves is by means of bell-crank levers. One end of the bell-crank pushes the valve rods, while the other end oscillates around a stationary shaft which has a fixed support placed in the cam box. At the center of each bell-crank lever is a roller against which the cam for operating the valves rotates. The closing of the valves is effected through the action of coil springs. The admission and exhaust cams are bolted and keyed on the same shaft at 180 deg. The several valve-motion parts, as well as the centering springs and the high-pressure admission valves which are subjected to a very high temperature, are made of special Holtzer steels.

The real advantage resulting from the use of the Lentz valves and from the procedure adopted for the steam passages in the cylinders should be explained. As was pointed out in the beginning of this study the extent of throttling found in the high-pressure cylinders of the 4-6-2 type locomotives equipped with piston valves, as compared with the throttling which existed in the corresponding cylinders with flat slide valves on the 4-4-2 or 4-6-0 type locomotives, showed that the area of the ports had only an illusory significance when the valve motions of the different systems were compared. The effective passage area which regulates the flow of steam through different distribution systems depends, as a matter of fact, on the contraction experienced by the fluid flow in passing through the orifices of the different steam passages.

To be able to compare with exactness the passage areas thus offered to the steam with different types of valve motions, it is necessary to make a careful check with the aid of indicator diagrams.

The double slide-valve throttle was replaced with a throttle with balanced valves of American design. The steam is conducted from the throttle to the collector and thence from the collector to the steam chests through pipes of large diameter—6½ in.

The exhaust consists of two exhausts which function in parallel. The two exhaust pipes are placed one behind the other, as shown in the elevation drawing. Each one of the exhausts has a Kylchap nozzle and a cylindrical bell-shaped nozzle, the latter being placed immediately above the Kylchap nozzle. Each one of the cylindrical nozzles is provided with a four-bar primer, which is placed perpendicularly to and directly above each of the central dividing partitions of the two Kylchap nozzles.

The cylinders, valve motion parts and cam-shaft bearings are lubricated by a Bosch type mechanical lubricator having 20 outlets. This lubricator is located in the cab and is actuated by a drive connected to that of a recording speedometer. Relief valves of Woerner design are placed at the junction points of the lubricating-oil pipes and as near as possible to the points to be lubricated.

The air compressor is lubricated by a Detroit lubricator having one outlet.

To combat the beating down of smoke from the stack, two lateral screens of the type adopted as a result of tests made in the aero-dynamic laboratory of Saint Cyr* have been placed in front on each side of the smokebox, as shown in one of the illustrations.

Road Tests with Locomotive No. 3566

Two series of road tests were conducted with locomotive No. 3566. The first series was to make a comparison between the rebuilt locomotive and the best high-speed locomotives in service on the system and to investigate the limit of the power of locomotive No. 3566, by having it haul suitably overloaded trains. The second was to make a study of the performance of the rebuilt engine and included the taking of indicator diagrams on the cylinders.

Thirty-four tests were run on regular trains between St. Pierre-des-Corps and Angouleme, 126¾ miles; six special trains were tested between St. Pierre-des-Corps and Bordeaux-St. Jean, 216¼ miles, and two special trains between Les Aubrais and Bordeaux-St. Jean, 285¾ miles. The profile of these sections of line includes grades up to 0.5 per cent.

For the tests in regular service, south and north runs were selected, scheduled, respectively, for nominal speeds of 59 and 46½ m.p.h. The corresponding tonnages were about 364 and 547 tons, which corresponded substantially to the maximum loads provided for the 4-6-2 type locomotives of standard design. Six trains on each of these runs hauled by locomotive No. 3566 had the nominal speed increased, respectively, from 59 to 68¼ m.p.h. and from 46½ to 56 m.p.h. Likewise two trains on each run with this accelerated speed had their tonnages increased, respectively, from approximately 364 to 552 tons and from 547 to 643 tons.

Fuel and Water Consumption of Locomotive No. 3566

Figures are from results of selected dynamometer-car tests

Water consumption, lb. per hp.-hr.		Coal consumption, lb. per hp.-hr.	
In cylinders	At tender drawbar	Cylinders	At tender drawbar
Tests between St. Pierre des Corps and Angouleme—133 miles			
13.8	24.2	1.79	3.14
13.8	20.7	1.82	2.91
13.8	25.0	1.84	3.32
13.8	20.7	1.85	2.69
13.0	25.0	1.72	3.16
13.8	21.6	1.84	2.70
12.1	23.4	1.65	3.11
12.1	19.0	1.62	2.46
Tests between St. Pierre des Corps and Bordeaux-St. Jean—216.24 miles			
11.2	19.8	1.59	2.69
12.1	19.0	1.70	2.50
12.1	18.1	1.65	2.31

In regard to the locomotives with which No. 3566 was compared, the data were as follows: Six trains in each direction were hauled by a standard 4-6-2 type locomotive, series No. 3551 and 3589, equipped with a Houlet superheater and a Kylchap exhaust. Four trains in each direction were hauled by a standard 4-6-2 type locomotive, series No. 3641 to 3670, equipped with a Schmidt superheater and an exhaust having three Goodfellow projections. Locomotives of this series differ only in a few details from the series No. 3551 to 3589.

Two southbound and three northbound trains were provided with a second locomotive of the No. 3551 series, of which the two southbound trains had had their nominal speed increased from 59 to 68¼ m.p.h. and one northbound train from 46½ to 56 m.p.h. Two trains in each direction were hauled by a 4-6-2 type single-expansion locomotive, series No. 3591 to 3640, equipped with a Schmidt superheater and Kylchap ex-

* See the Revue Generale des Chemins de Fer for July, 1929.

haust. One of these trains in each direction was run at the increased nominal speed. It was not possible to make the same number of test runs with these last two locomotive assignments because of a failure of the low-pressure slide valves of the compound locomotive and the vibration of the cylinders of the single-expansion engine on the higher speed schedules.

The special trains hauled by engine No. 3566 had tonnages estimated from 349 to 592 tons and nominal speeds of 62, 65¼ and 68¼ m.p.h.

To eliminate errors which might result from the use of different steam-chest pressures, according to the composition of trains and habits of engine crews, all the tests were made with wide-open throttle. The regulation of the power developed by the locomotive was made by means of the brakes. To further eliminate the personal equation the locomotives compared were handled by the same engine crew.

The fuel used had a heating value of about 14,000 B.t.u.

Practical Results Obtained

The alterations made on locomotive No. 3566 made it possible to substantially increase the load and the speed of the trains previously hauled by the 4-6-2 type locomotives. It was possible on one test to increase the load from 349 tons to 558 tons, while the nominal speed was increased from 59 to 68¼ m.p.h. This is, as compared with what is done with ordinary 4-6-2 type locomotives, a load increase of 209 tons and a gain in time of 20 min. on the stretch of 133 miles from St. Pierre-des-Corps to Angouleme.

With another train it was possible to haul 642 tons at a nominal speed of 56 m.p.h. This is a tonnage gain of 64.2 tons and a gain in time of 35 min., compared to the maximum made with the locomotives in regular service.

Finally, the low water consumption of the locomotive made it possible to cover, without stopping, the distance from St. Pierre-des-Corps to Angouleme with a tender tank of 5,820 gal. and a load of 357 tons, at a nominal speed of 68¼ m.p.h. With a tender of 9,800 gal. the distance from St. Pierre-des-Corps to Bordeaux-St. Jean, 216¼ miles, with a load of 444 tons, was covered at a nominal speed of 68¼ m.p.h. and also with a load of 494 tons at an average speed of 62 m.p.h. when the train was steam heated at a pressure of 85¼ lb. per sq. in.

The results obtained in the course of these tests justified the expectation that it is possible to haul trains with a load of 444 tons at an average speed of 68¼ m.p.h. from Aubrais to Bordeaux, 286 miles, with one stop for water at Poitiers.

Contrary to the 4-6-2 type locomotives in regular service, both compound and single-expansion, locomotive No. 3566 could maintain, without difficulty and as long as desired, speeds of around 74½ m.p.h.

Boiler Performance

In spite of the presence of a superheater of large dimensions, a circumstance that is little favorable to the good thermal output of the boiler, and an inferior coefficient of heat transmission between the combustion gases and the steam, the boiler of locomotive No. 3566, provided with a Thermic syphon and double exhaust, has proved to possess a mean thermal output that is substantially equal to that of the boilers of the locomotives with which it was compared.

The thermal efficiency of the boiler of locomotive No. 3566 being substantially equal to that of the locomotives under consideration for the same rate of hourly combustion, it was found that with equal power developed the effective thermal output obtained with the boiler of this locomotive became greater than that of the other locomotives as soon as considerable power was produced. This efficiency is more constant for the rebuilt engine than for the ordinary locomotives. This result, which confers on the boiler of locomotive No. 5366 considerable elasticity with respect to steam generation, can be ascribed to the Thermic syphon, because of the more active circulation of water which gives to the heating surfaces the ability to absorb quantities of heat which remain substantially proportionate to the coefficient of the load on these surfaces.

This result must also be ascribed to the effect produced by the double exhaust which forces into the firebox a quantity of air that is always well proportioned to the process of the combustion, especially at peak loads on the boiler.

The temperatures vary from 662 to 752 deg. F. according to the demands on the locomotive. At the same time the superheating temperatures obtained when the feedwater is preheated are lower than those which are obtained when the feeding is done by an ordinary injector.

Comparison of the Maximum Horsepower Developed at the Tender Drawbar and in the Cylinders

Date	Tons hauled	Distance, ft.	Running time, min.-sec.	Average speed, m.p.h.	Average force at tender drawbar, lb.	Avg. hp. exerted: Dynamometer-car reading, hp.	Avg. hp. exerted: Cylinder hp.	Remarks
12-16-26	497	42,652	7-0	62.14	8,333	1,380	2,075	Locomotive No. 3579 — Tests run between Paris and St. Pierre des Corps
12-16-26	497	55,775	10-6	62.76	7,390	1,238	1,923	
12-21-26	414	52,494	9-36	62.14	5,717	1,164	1,954	
12-21-26	414	72,180	11-11	73.32	4,850	948	1,738	
4- 4-30	406	9,843	1-31	73.82	8,951	1,762	3,030	Locomotive No. 3566 — Tests run between St. Pierre des Corps and Angouleme
4- 5-30	650	39,371	8-12	54.56	11,905	1,737	2,465	
4- 8-30	625	14,764	3-5	49.10	13,779	1,805	2,545	
4- 8-30	625	26,247	4-24½	67.73	9,832	1,775	2,762	
4- 8-30	625	78,742	12-20	72.70	7,804	1,515	2,465	
4- 8-30	625	49,214	7-54½	70.71	8,653	1,632	2,663	
4- 8-30	625	21,326	3-52	62.76	10,858	1,810	2,710	
4-10-30	620	28,052	4-33	70.21	9,921	1,860	2,915	
4-11-30	724	55,775	11-32	54.93	12,125	1,778	2,140	
4-11-30	724	49,869	9-8	61.21	10.692	1,752	2,265	

Increase in Thermal Efficiency

The heat drop of the steam in the cylinders of the rebuilt engine is notably greater than the heat drop obtained in the cylinders of the locomotives of similar type in regular service.

The thermal efficiency corresponding to this heat drop changes from 11 per cent for the ordinary engine to 14.5 per cent, approximately, for the rebuilt locomotive; that is, an increase in thermal efficiency of more than 30 per cent, or a saving in heat by the rebuilt locomotive, as compared with the ordinary locomotive of similar type, of about 25 per cent. If this efficiency is compared with the efficiency of the corresponding Rankine cycle, it will be seen that the relation between these two efficiencies, which measure the degree of perfection of the actual engine as compared with the theoretical engine, passes from about 62 per cent for the ordinary engine to 75 or 80 per cent, according to the degree of superheat used for the rebuilt engine.

If one compares the effective outputs of the cylinders of the rebuilt locomotive on the basis of the water-consumption data, taking into account the quality of the steam produced, it will be found that there is little difference between the thermal efficiency calculated on an

entropy diagram according to the actual heat drop experienced by the steam in the cylinders of the engine and its effective output deduced from the water consumption data. Thus, for a mean value of the actual efficiency of the cylinders of the engine, calculated on six test trains to be 13.84 per cent, the corresponding mean of thermal efficiencies, calculated according to the effective heat drop of the steam in the engine, is 14.3 per cent. The relation between these two figures is 0.97. Allowing for errors in measurement, it corresponds to the heat losses through exterior radiation which would thus reach about three per cent.

One of the principal differences existing between the rebuilt locomotives and the ordinary locomotives lies in the combinations of the high-pressure and low-pressure running cut-offs that can be used on this engine.

In the ordinary compound locomotives, notably in the French compound locomotives with independent high-pressure and low-pressure valve motion, experience has led to the general adoption, as the best cut-off for the low-pressure cylinders, the figures of 60 to 75 per cent. It was possible on locomotive No. 3566 to use much lower degrees of admission in the low-pressure cylinders, combined with the high-pressure admissions in the following manner:

High-pressure admissions, per cent	Low-pressure admissions, per cent
70	60
60	50
50	45
40	42.5
30	40
20	40

The exhaust pressures, in the receiver between the high- and low-pressure cylinders on the old engine, were as high as 49.78 lb. when mounting grades, 28.45 lb. as a maximum at high speed and at full power, and 14.22 lb. at reduced power. However, for locomotive No. 3566 these pressures have increased to 85.34 lb., 56.89 lb. and 35.56 lb., respectively.

These running conditions have brought with them a more equal division of the power developed between the high-pressure and the low-pressure cylinders. Thus between 1,972 and 2,960 hp. the ratio between the work developed by the high-pressure cylinders and the work developed by the low-pressure cylinders has become substantially equal, whatever the speed under consideration. For power lying between 1,480 and 1,972 hp., this ratio varies around 1.5, while in the ordinary compound engines the high-pressure cylinders develop from three to ten times greater power than that produced by the low-pressure cylinders. The combination of cut-offs used on locomotive No. 3566 makes it possible to approach the conditions of theoretical operation, according to which the loss, due to pressure drop without being performed in the exhaust, should be equal to zero. This is a point with respect to the functioning of compound locomotives which has been the reward of a long period of development.

In numerous cases high running cut-offs continue to be used on the low-pressure cylinders of compound engines using superheated steam. This is because the throttling at the low-pressure admission assumes excessive values in the case of small admissions which neutralize and more than neutralize the advantage due to the decrease in exhaust pressures.

The importance of the throttling thus produced in the low-pressure cylinders seems to be the sole reason which prevents the nearly equal distribution of the work developed between the high-pressure cylinders and the low-pressure cylinders, as the latter performs only a very small fraction of the total work during the larger part of the time.

The large steam passages in the low-pressure cylinders of locomotive No. 3566 made it possible to be relieved of the preceding requirements and to raise the low-pressure cut-off to the full extent necessary to obtain an equal distribution of work between the four cylinders.

Performance of Locomotive No. 3566

The consumption figures obtained with locomotive No. 3566 are small, varying from 1.6 lb. to 1.9 lb. of coal per indicated horsepower-hour, and from 11.5 to 13.94 lb. of water. The corresponding consumptions of fuel and water per horsepower-hour developed at the drawbar varied from 2.21 to 3.3 lb. and from 17.78 to 24.62 lb. gal.

The savings made by locomotive No. 3566 over the standard compound locomotive fell between 12.6 per cent for water and 10.35 per cent for coal, as the lower limit, and 19.10 per cent water and 18.71 per cent coal, as the upper limit, according to the tractive force demanded of the engine. The boiler was fed by a standard injector. With the feedwater pump these savings increased to 21.21 per cent water and 16.86 per cent coal on a test run scheduled at 59 m.p.h. and to 25.35 per cent water and 25.80 per cent coal for a train scheduled at an average speed of 56 m.p.h.

It is important to note that on the standard 4-6-2 type compound and the single-expansion locomotives increasing the speed with no increase in load brought with it a remarkable increase in the consumption of water and fuel. On locomotive No. 3566, however, the consumptions remained substantially independent of the tractive force demanded, even when running at accelerated speeds.

Conclusions

Summarizing, the modifications made to the locomotive No. 3566 produced important improvements. They had for effect (1) an increase in available tractive force at the drawbar of about 50 per cent; (2) less consumption of water and fuel—(a) at lower power output about 10 per cent when the boiler is fed by the injector and about 15 per cent when fed with the A.C.F.I. integral pump, and (b) at larger power output about 20 per cent when the boiler is fed by injector and 25 per cent when fed by pump; (3) to increase the practical speed limit to at least 74½ m.p.h.; (4) to produce satisfactory performance and life of mechanical parts even when the maximum tractive force is developed at high speeds for long periods of time.

In view of these results the Orleans Company is rebuilding twenty 4-6-2 type locomotives according to the design developed with locomotive No. 3566. These are locomotives Nos. 3501 to 3520, inclusive, using saturated steam. They were constructed in 1909.

The new power will differ from locomotive No. 3566 by raising the safety valves from 228 to 242 lb. per sq. in. and by replacing the 32-element Robinson superheater with a 28-element Houlet superheater. This will make it possible to increase at the same time the thermal efficiency of the boiler and the passage areas for the gases through the superheater flues. This increase of the passage section for the gases will also make it possible to increase the size of the exhaust pipe and to further diminish the back-pressure on the pistons.

The diameter of the low-pressure admission valves will be increased from 8.66 to 9.45 in., thus profiting to a greater extent from the use of early cut-offs in the low-pressure cylinders.

Make Your Car Foremen Your Assistants*

By T. W. Demarest†

Decreases in divisional overhead supervision and the centralization of supervisory control is leading to a better recognition of the car foreman's responsibilities. Dependence must be placed on him as a directly responsible officer in the control of his own operations

An important aspect of the problem of getting improved car-department operation is the question of personnel—the kind of men we are developing, and their training, so that they may not only carry on but be able to meet and conquer the new conditions. The past decade has been a period of evolution and it is apparent we are on the verge of another. For at least forty years prior to the period of federal control there had been only minor changes in the operation of car departments. While the old-time master car builder was gradually passing out—and all honor to him—each transportation yard still required a shop repair track. It was still the practice to build a proportion of new cars at the home shops; still the practice, to an extent, to defer car repairs at the first sign of a depression and then when business picked up to order new cars, more or less heavily. It would have been much cheaper to have repaired the bad-order equipment, except that usually the new cars ordered were of better design and larger capacity than the older cars.

At the end of the federal control period, some of us were in almost the last stages. To live at all, immediate constructive measures were necessary. It began to dawn on us that there were too many intermediate terminals and that if a freight car could not be put in shape to run as far as a passenger car without intermediate repairs, it should at least be able to run as far as a locomotive, i. e., over two or three crew divisions; also, that a light-repair track was no place for heavy-repair cars and that the latter operation had better be centralized.

A New Period of Evolution Now Beginning

I believe we are at the beginning of another evolutionary period, and it is essential that we ask ourselves, as relating to car inspectors and car foremen: Will these men occupy more important positions than in the past? Are we paying sufficient attention to the selection and development of the right kind of men? In what ways can they improve their efficiency and conserve expenditures for maintenance? It is apparent there is some unavoidable overlap in these questions; but let's discuss them.

Will Car Inspectors and Foremen Occupy More Important Positions?—Insofar as the car inspector is concerned, I would answer "no" and "yes" to the first question. As the result of the development of modern car design, car construction and materials used, the work of the inspector is being materially lightened. The transportation yard inspector should know car construction and materials, and we should be able to depend on his judgment as to the necessity of shopping out a car. He will, of necessity, have to be a bigger man than he is now, and have more responsibility.

The car foreman will have no more responsibility, but his responsibilities will be better recognized and he will be made to assume them. I feel safe in saying that in the period prior to the last decade the car foreman was generally not permitted the development of initiative, nor educated to assume responsibility, his duties being largely confined to direct supervision of labor, with no breadth of contact with the other departments and with small knowledge of costs. When I say costs, I mean it in the broadest way—not the effort to do as little work on the car as would permit him to get it off his hands; not the effort to use unfit material, i. e., material which has practically lived its life; not to have any knowledge of the effect of his operations on transportation costs, but to have the realization that a permanent repair, economically made, is the only cheap repair. I am afraid also that if transportation-yard inspection forces were under his control, as well as the repair-track forces, the proper relation of the different classes of employees to one another was not sufficiently studied.

Selection and Development of the Right Kind of Men.—Good railroad operation hinges largely on the enginehouse and transportation yard. The car foreman is an essential link in transportation-yard operation, and a very vital factor in economic freight-car maintenance. We, perhaps, are just beginning to obtain a better perception of the place he should occupy in our organization, this appreciation being brought about by decreases in divisional overhead supervision, the centralization of supervisory control, and the placing of the car foreman on his own feet as a directly responsible officer.

In the Pennsylvania organization, I am afraid we have given more attention to the car foreman than we have to the car inspector, influenced, no doubt, by the fact that we are making the car foreman the responsible head, not only for repair-track activities, but also for transportation-yard activities, including inspection, lubrication, tests, etc. The foreman of car inspectors is superseded by a gang foreman of car inspectors, who reports to the car foreman. In our education of the car foreman, we have not progressed far enough yet to develop car inspectors for the duties we believe will devolve on the latter in the future.

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* Abstracted from a paper presented before the initial Fall meeting of the Car Foremen's Association of Chicago, held at the Great Northern hotel, Chicago, Monday evening, September 14.

† Mr. Demarest is general superintendent of motive power of the Western Region of the Pennsylvania.

In What Ways Can Car Men Improve Their Efficiency?—I believe, in this question, the cart is before the horse in that it does not recognize the fact that we must first educate ourselves before we can hope to educate our employees. We cannot escape our responsibility and assume that the car inspector and car foreman must do our thinking for us or that they can take our place. Let us revise the question and ask ourselves: "What can we do in the education of our car inspectors and car foremen to increase the efficiency of our operations and decrease our maintenance costs?"

In the Pennsylvania organization, the car foremen and their car forces come directly under the master mechanic who has the car as well as the locomotive departments under him. The master mechanic in turn reports to a superintendent of motive power, who reports to the general superintendent of motive power. The latter has as a part of his organization a chief car inspector, and, if the territory is large enough, the latter may be assisted by one or more general car inspectors. The duties and work assigned to the chief and general car inspectors are such that they are office men for not more than one day a week. It may be pertinent to mention here also that while we have a stores department, this is not a separate department as on many roads, but the storekeepers report to the master mechanics, and the motive power department holds itself directly responsible for the quantities of unapplied material on hand. The above explanation is necessary to clarify what follows.

"We must first educate ourselves before we can hope to educate our employees. We cannot escape our responsibilities and assume that the car inspector and car foreman must do our thinking for us, or that they can take our place**. Unless we as superior officers are looking ahead; are able to see that conditions are going to change; have solutions for them in advance, and believe in what we advocate, we are not going to develop men."**

The first man we have to start with is the general superintendent of motive power. Unless, we, as superior officers, are looking ahead; are able to see that conditions are going to change; have solutions for them in advance; and believe in what we advocate, we are not going to develop men. We have to pass this education on to our subordinates, the superiors of the car foremen, and then to the car foremen, themselves. The easy man to educate is the car foreman; the hard men to educate are his superiors.

Car Men Cannot Be Directed by "Remote Control."—Some operations on a railroad may be handled by "remote control." The education of men and proper control of maintenance costs are not only included in such operations. Letters of instruction are not valuable; they are simply a matter of record. The follow-up, by personal visits and full verbal reasons and explanations, is the only way to bring results and continued improvement. You may be interested in a resume and a discussion of the ground covered during personal visits and the direction taken in our educational efforts with our car foremen.

Cleanliness and Orderliness.—We insist on cleanliness on repair tracks, in buildings, in the space occupied in transportation yards, and an orderly method of caring for tools and supplies. We believe that a primary requisite in the development of men, in obtaining the proper kind of work, and in facilitating maintenance, is a clean, orderly shop and surroundings. We do not believe that good men can be developed in any other surroundings, and we also believe a good man will not only lose his self-respect if compelled to work under other conditions, but will become like his surroundings.

The Reason for Shopping Cars.—In checking over a repair-track situation with a car foreman, we desire to know that he is thoroughly acquainted with the work on his track, why each car has been shopped, when it will be released, the reason for the delay, if any, and whether the reason for shopping the car was a valid one. No car foreman can operate a freight-car repair track economically unless he knows at all times the conditions of his track. We also desire to ascertain whether he has so many cars shopped to his track that he cannot handle the work promptly. Good repair-track operation means the ability to get to the cars promptly after they are set, and release them as rapidly as the work is done.

Quality of the Work Being Done.—Continuous checking is necessary in order that superficial as well as unnecessary repairs be not made and that the repair work being done is completed in a permanent manner; also, to see that instructions in reference to the methods of doing work and the use of material are being followed.

Handling of Loaded Shopped Cars.—The number of loaded cars on his track is carefully gone over, and also the shop records, to indicate whether or not there are shopped-out loads in transportation yards which have not yet been set. His instructions are to handle foreign bad-order loads first, in order to relieve per diem, and, secondly, loads in system cars.

Delays in Movement of Empty Cars.—The empty-car situation is also gone over with him, in this instance foreign empties to be given preference; whether or not there are foreign empties standing out, and why they have not been set; material shortages, if any. System empties are to be given last consideration.

Extent of Yard Damage.—Bad orders being shopped out on account of yard damage are checked over. If necessary, the matter is called to the attention of the yardmaster and perhaps also to the division superintendent and the general superintendent.

Method of Carrying Material and Amount on Hand.—His material supplies are gone over, not only on the repair track, but also in the transportation yard. The condition in which his material is kept, that is, whether or not he is a good storekeeper, and the amounts of the various kinds of material he has on hand, are checked against his consumption records. If there are excess amounts in any direction, he is instructed to send them to our general store-room and is advised that one method of reducing purchases is to make surplus stocks available for regional use rather than divisional.

Relations with the Yardmaster.—We develop whether

or not the yardmaster and car foreman are co-operating fully, and iron out any differences or kinks which may exist. It goes without saying that in the prompt movement of trains, the elimination of per diem, and delay to loads, the two officers must co-operate thoroughly with each other.

Proper Force Relation.—The various labor classifications of his force are gone over with him, and, if necessary, suggestions made to obtain a better balance or possible reductions. The assistant foreman and gang foremen are checked over with him to develop if they function properly; what, if any, further educational means must be taken with them to make them desirable supervision; and whether or not any of them have not reacted and should be set back. If he feels he has any exceptionally bright workmen in his organization who seem to have qualities fitting them for promotion, such men are also discussed with him.

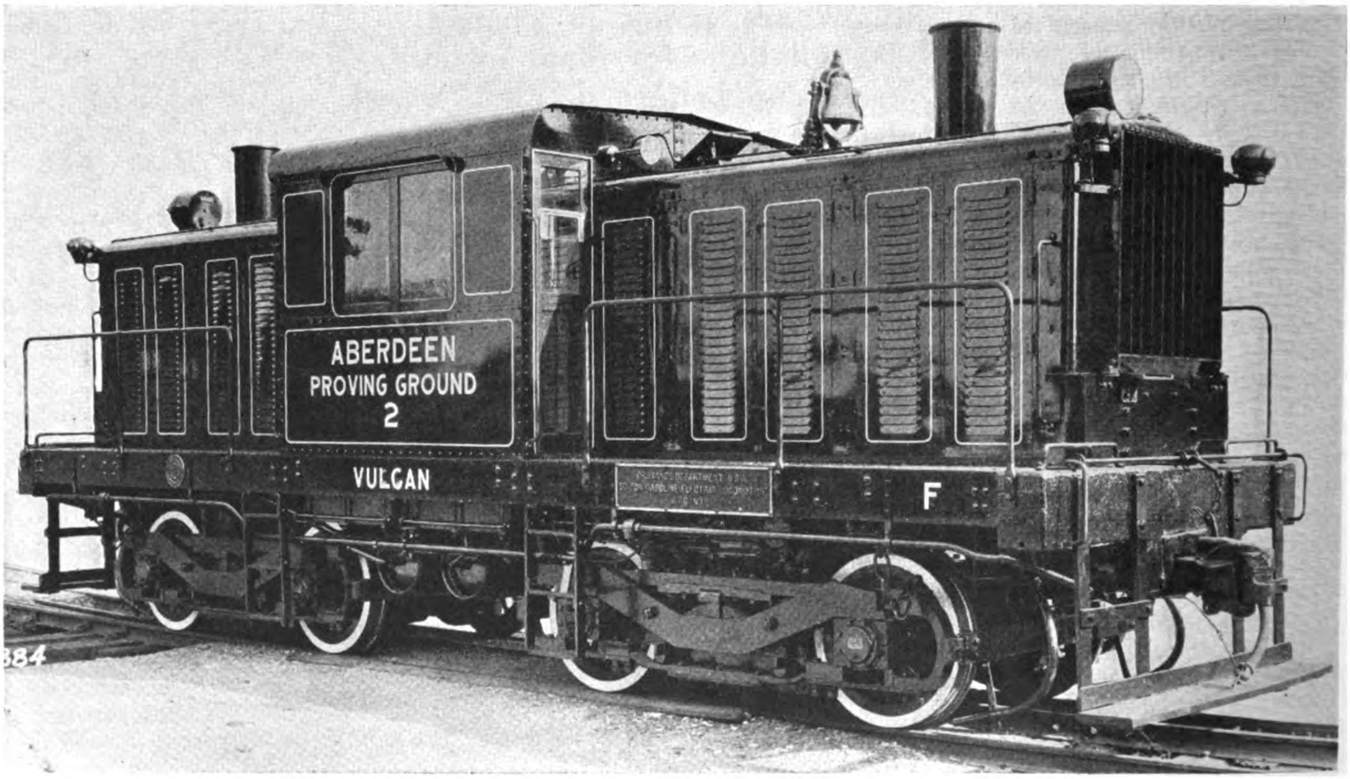
Expenditure of Labor and Material to Date

Our own railroad, as well as a great many others, in order to regulate expenses, operates on a budget plan, and just as we receive our budget allotment for freight-car maintenance for the current month, we, in turn, based on the chief car inspector's knowledge of the requirements at the different repair tracks, budget each one of the repair tracks. The budget is not in the shape of dollars of expenses, but an allotment of man-hours, mechanics and helpers, for the month. The allotment is distributed as between lubrication, inspection and repairs.

The budget allotment to the various expense items in our maintenance-of-equipment appropriation in the majority of cases in the Western Region is on the basis of man-hours, mechanics and helpers, without reference to material. On our car repair tracks, however, we have found it necessary to have a material measure also, as the consumption of some of the more costly items is sufficiently erratic at times to produce an unexpected over-run of an undesired under-run. Each gang foreman, therefore, has a sheet he fills out daily on which there are some 25 separate material items which constitute 80 per cent of the material costs of freight-car repairs, such as air-brake details triple valves, etc., wheels and axles, couplers, draft gear, body and truck bolsters, brake beams, journal bearings, etc. These items are priced on the sheet and as the gang foreman draws any of them for application he simply marks the number of pieces in the appropriate column. At the end of the day he abstracts from his time cards the mechanics' and helpers' hours in his gang. These hours are turned into money at an average rate set up for the track each month by the regional accountant. He figures his total material cost and his ratio of material per dollar's worth of labor. As the operations of different tracks vary, a ratio of material to labor is set up for each track and when this ratio is exceeded the car foreman must take individual action to see that his labor and material allotment is not exceeded. The plan has worked very well, indeed. Frankly, we are trying to make business men of our car foremen and it is quite astonishing how they have been able to readjust their forces without decreasing output, to maintain their operations without exceeding their allowances. It has also exercised a very salutary influence in reducing material charges.

Finally, in relation to the education of car foremen, may I suggest that in meeting with and going over various questions with your car foreman, that you deal with him as if he were an assistant of yours and not a subordinate. He knows a lot of things that you don't know and I have never gone over a car-repair track or through an enginehouse that I did not learn something from the foreman, as well as from the men.

* * *



A 50-ton gas-electric locomotive built for the Ordnance Department, United States Army, by the Vulcan Iron Works
Power plant: 2,175-hp., 6-cylinder LeRoi engines driving General Electric 500-volt generators—Starting tractive force 36,000 lb.; maximum speed, about 30 miles an hour.

Scale Prevention in Closed Feedwater Heaters

*By Julius Alsberg**

Results of research begun by the Superheater Company in 1922 to eliminate scale in closed feedwater heaters

THE operation of closed feedwater heaters on locomotives has in many instances been handicapped by excessive scale formation. This has been true of all those roads that use boiler feedwater containing substantial amounts of calcium or magnesium in the form of bicarbonates. These salts come readily out of solution when the water is heated to temperatures of 200 to 230 deg. F., which can be attained in closed heaters heated with exhaust steam.

Many waters that produce hard scale in the boiler do not affect feedwater heaters seriously because such waters, when chemically softened, produce boiler scale by reason of the preponderance of sulphates of lime or magnesia, which sulphates come out of solution at boiler temperatures, but not at the temperatures which are obtained in exhaust-steam feedwater heaters. Thus, those railroads which use softening compounds within the boiler only may not be troubled with much scale in feedwater heaters.

On the other hand, waters that are softened in wayside tanks or locomotive tenders will deposit scale in the heaters, because the softening process converts the sulphates of lime and magnesia into their carbonates, a portion of which are converted into bicarbonates and retained in solution in the water. These bicarbonates, as pointed out, come out of solution at heater temperatures. The insides of the heater tubes then become covered with soft and porous carbonate scale, which builds up the more rapidly the greater the concentration of bicarbonates in the water. Thus water, treated with soda ash only, creates greater difficulties in closed heaters than waters which are treated with soda and lime, because the addition of the latter has a tendency to decrease the amount of calcium and magnesium bicarbonates.

Although the carbonate scale is soft and porous, it appreciably interferes with the heat transfer through the tube walls, lowers the capacity of the feedwater heater and results in decreased fuel saving. When the deposit is allowed to accumulate over extended periods of time, serious stoppages of heater tubes occur, which increases the load on the pumps and proves particularly obnoxious to centrifugal pumps, which fast lose capacity with the rise of head against which they have to pump.

Effect of Leaky Boiler Checks

These troubles are usually accentuated by a tendency of boiler checks to leak in spite of proper maintenance. Such leaks increase the water temperature in the heater tubes when the engine is standing considerably beyond the temperatures which obtain during the use of the heater, so that harder scale-forming ingredients, such as sulphates and silicates, may become mixed with the carbonates and destroy the soft porous character of the deposit. It has thus been customary to clean the heaters periodically with dilute muriatic acid which readily acts on the carbonates, producing calcium and magnesium chlorides and carbonic acid gas.

Realizing that the proper way to deal with the problem is the prevention of scale formation by some means rather than allowing the scale to form and remove it by acid, The Superheater Company initiated a study and research on this subject as early as 1922 and more recently carried this work to what appears to be a satisfactory ending.

Use of Anti-Foaming Compounds

Early in its experience of servicing its heaters on railroads this company observed that the use of anti-foaming compounds was helpful in keeping heater tubes clean. This fact was recognized to be due to the collodial action of tannin, one of the ingredients of such compounds.

Tannin, which is an organic substance found in the pulp of the wood and in the bark of a number of trees, such as chestnut, oak and others, is available in the form of liquid extract or in the form of powder. When mixed with water, it goes into a so-called colloidal state which, as is well-known, is really a state of suspension, but of particles so small that they indefinitely stay in that suspension without settling. Colloids, such as tannin and others, have the interesting property of protecting certain other classes of colloids against coagulation (precipitation). This phenomenon is probably related to the character of the electrical charges carried by both the particles of the protecting colloid and by those of the colloid to be protected.

When water carries a mineral substance such as bicarbonate of calcium in solution and is heated to a temperature at which it comes out of solution the bicarbonate, as the theory affirms, is converted into the much less soluble carbonate. The carbonate thus formed first passes through a colloidal state before passing into the crystalline state in which it agglomerates into the scale-forming crystals which are deposited on the heat transmitting surfaces. Thus, when a sufficiently powerful protective colloid—for instance, tannin—is contained in the water when the heat drives the bicarbonates out of solution, the carbonates are being retained by the protective action of tannin in the colloidal state and are not allowed to pass into the crystalline form, and the precipitation of carbonates on the heater tubes can be entirely prevented.

Definite data will be published eventually, but it can now be safely stated that the quantity of tannin required to give good practical results with waters which are softened with lime and soda, and should therefore not contain excessive amounts of calcium or magnesium bicarbonates, can be held small enough so that the cost

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of the treatment compares favorably with the cost of heater washouts. On one railroad, for instance, the addition of 1 lb. of tannin to about 60,000 lb. of water allowed a heater to operate during three months without acid washing, with a loss of not over 25 deg. F. in preheating temperature, whereas heaters have to be washed on that road every ten days to two weeks to be able to secure satisfactory results.

Tannin-Brick Treatment

The most difficult part of the problem was to find a practical and economical means of feeding the tannin. It was felt that in order to obtain a uniform dosage without waste of the fairly expensive material an automatic feeding means should be developed, and consequently a number of devices were tried for feeding both liquid and powdered chestnut extract in proportion to the quantity of water pumped. None of these devices proved satisfactory, largely on account of the tendency of the tannin-bearing extract to oxidize, which caused gummy deposits on pipes and valves through which the material had to be handled. Finally, powdered extract was successfully briquetted into a structure permeated with glue tannate which shows considerable resistance to rapid leaching and from which the tannin goes into solution very gradually.

Briquettes have been made which are rugged for handling at terminals. They are placed in wire baskets and lowered on chains to the bottom of the tender tank through the manhole. The water flowing over the brick into the pump suction slowly leaches the tannin out of the brick structure. The amount of tannin can be, to some extent, regulated by the surface of the briquette as well as by modification of its structure. There does not seem to be any trouble about making briquettes which last from 30 to 35 hours before they completely dissolve in water at 45 to 55 deg. F. As a result, bricks may be made to last throughout the round trip of a locomotive in many instances so that they have to be handled at one terminal only. In any event the bricks will last long enough that the locomotive crew need take no part in administering the treatment. At the same time the maintenance forces are not burdened by the addition of a mechanical feeding device.

Briquettes could also be made for insertion into suitable containers placed in suction or pump delivery pipes, but since tannin is also of the greatest help in keeping scale out of injector tubes and with the location of the brick in the tender no joints have to be made or remade when adding more brick, the basket method seems to be the most suitable.

The tannin-brick treatment was developed for the use of those railroads operating Elesco heaters but not introducing tannin-bearing compounds into the tender water. Where such compounds are used and, incidentally, good feedwater temperatures are maintained without an undue amount of acid washing, the use of additional tannin brick is not indicated. Where they are used but satisfactory feedwater conditions are not obtained, it seems probable that they can be obtained by using tannin brick in addition to the boiler compound or else the latter modified so as to include a sufficient amount of tannin for heater scale prevention.

Whether an emulsion of castor oil and tannin as used in anti-foaming compounds is as effective a protective colloid at heater temperatures as tannin by itself is a question which must be answered by experience. Offhand, it would seem that the tannin must lose at least part of its protective power when emulsified in castor oil.

D. & H. Builds 100 Box Cars

(Continued from page 526)

cars is known as the Youngstown steel door. It is carried on Camel bottom supports with roller lock-lift arrangement. The construction is such that when at rest the entire weight of the door is shifted from the rollers to the bottom door track. The door is bottom hung and operates on rollers which are provided with roller bearings. To open or close the door it is only necessary to pull down slightly on the lifting lever which is stenciled "Pull." The movement of the lever raises the door from the track and its weight is transferred to the rollers. Above the door opening is a retaining Z-bar. When the door is closed this bar seals the top of the door and prevents water from entering the interior of the car. An additional feature is the door lock and wedge-shaped sealing pin. If this type of door is allowed to remain open, either fully or part way, it remains in that position until released. Thus, damage to the door, posts, guides, etc., is minimized.

The Operation of the Spot System

Construction of the cars was facilitated by the use of effective labor-saving devices and equipment. For example, at the truck assembly station there is a one-ton air-motor hoist which travels on a boom having a 16-ft. radius. The two men engaged in assembling the trucks are thus relieved of the labor of handling the heavy bolsters and side frames. When the trucks are completed they are advanced to the point where the center sills are stored. Here the sills are placed on the trucks by means of a one-ton Fordson gasoline tractor equipped with a 14-ft. boom. This tractor also carries the cover plate, side sills, side-sill angles and top-side angles from points of storage to the underframe assembly station.

Draft-gear units are compressed in the yokes under air pressure in a machine specially designed for the purpose. They are then conveyed on a three-wheel wagon equipped with an air jack and raised to the proper position under the car. The coupler is then elevated by an overhead air-motor hoist and the installation completed with but little manual effort.

The steel superstructure and Hutchins channel-steel ends are laid on metal horses, riveted together and then placed in position on the underframe by means of overhead air-motor hoists. At the last station the Hutchins Universal roof is assembled. The work is carried on from an overhead platform where the various roof parts are readily accessible.

With the exception of the truck and paint work, the building operations are completed under cover. As is the case at any plant where piecework is the basis of compensation, the material layout has been closely studied and the car parts, so far as possible, stored in close proximity to the station where needed. The distribution is handled by two men, also on piecework.

Each car receives two spray coats of paint. The color of the super-structure, excepting the roof, is brown, while the roof, underframe and trucks are painted black. The appropriate stenciling and markings are applied by air-operated spray-painting equipment. Under this arrangement metal stencils are employed, thereby assuring uniformity of application. Consequently the use of brushes is practically dispensed with. The cutting of paper stencils is no longer required because of the substitution of the metal stencils which seldom require renewal.

Dunn and Lee Elected Leaders of Simmons-Boardman Companies

New chairman of the board and president have been associated with the company for a quarter century—The former has been vice-president and editor-in-chief and the latter vice-president in charge of business department

Samuel O. Dunn,
Chairman of Board

Henry Lee,
President

THE election of Samuel O. Dunn as chairman of the board and of Henry Lee as president of the Simmons-Boardman Publishing Company, to succeed Col. E. A. Simmons, deceased, placed in executive charge of its management two men who have been associated with it for a quarter century. Mr. Dunn was born on March 8, 1877, at Bloomfield, Iowa. When 12 years of age, he began to learn the printer's trade, and at 18 was editor and publisher of a newspaper at Quitman, Mo. After four years as associate editor of the Maryville (Mo.) Tribune, he joined the staff of the Kansas City Journal in 1900, and was promoted to editorial writer two years later. Beginning in 1904, he was for three years an editorial writer on the Chicago Tribune, during which time he began to specialize on transportation matters.

Mr. Dunn became an associate editor of the old Railway Age in January, 1907. A few months later he was made managing editor. On June 1, 1908, when the old Railway Age and the Railroad Gazette were consolidated to form the Railroad Age Gazette, he was appointed western editor. Mr. Dunn was appointed editorial director in 1910, and on October 1, 1911, succeeded W. H. Boardman as editor. At almost the same time, he completed the study of law to which he had devoted much of his spare time, and was admitted to the bar. Expansion of the company brought parallel expansion in his duties, as he became editor-in-chief of all papers acquired and established.

Mr. Dunn has been a frequent contributor to magazines and speaker on transportation subjects. He is the author of "The American Transportation Question," published in 1911; "Government Ownership of Railroads," published in 1913; and "Regulation of Railways," published in 1918, as well as numerous articles published in Scribner's, the Atlantic Monthly, the Review of Reviews, World's Work, Nation's Business, etc. He has lectured on transportation subjects at a large number of universities, and has spoken on transportation problems, before such organizations as the Investment Bankers Association, the Chamber of Commerce of the United States, the Railway Business Association, the National Metal Trades Association, the National Association of Manufacturers, the National Industrial Conference Board, the Rivers and Harbors Congress, and the Associated Traffic Clubs of America. He was a delegate of the American Railway Association to the International Railway Congresses at Rome in 1922, and at London in 1925. He is a member of both the Railroad Committee and the Inland Waterway Transportation Committee of the Chamber of Commerce of the United States, and is a former president of the Associated Business Papers, Inc.

In addition to his duties as chairman of the board of the Simmons-Boardman Publishing Company, Mr. Dunn will continue as editor of the Railway Age.

Mr. Lee was born at Hamlet, Ill., on May 25, 1884, and received his education at the Aledo, Ill., high school and at the Metropolitan Business College at Chicago. He joined the old Railway Age at Chicago in 1905, and was assigned to the news staff in 1906. A year later he was appointed associate editor and transferred to New York. Upon the consolidation of the Railway Age and the Railroad Gazette in 1908, Mr. Lee was transferred back to Chicago, and a year later was placed in charge of the make-up department at New York. Later in 1909, Mr. Lee was placed in charge of the copy service department, shortly after which he was made a sales representative of the company. He was elected secretary in 1910 and was elected also treasurer in 1911. Mr. Lee was elected a director of the Simmons-Boardman Publishing Company in 1912, and became vice-president and treasurer in 1916.

Mr. Lee has been active in various organizations, including the Federation of Trade Press Associations (now the Associated Business Papers, Inc.), of which he was secretary-treasurer in 1910-11. He was successively secretary, vice-president and president of the New York Business Publishers Association during the years from 1916 to 1919, and was a director of the Technical Publicity Association in 1918. During the war he served as chairman of the Business Press division for the several government loans, and following the war served for two years as a member of the Surplus Property committee of the War Department. In 1929, he was elected vice-president, director and member of the executive committee of the Simmons-Boardman Publishing Corporation, and in the same year was elected vice-president and a director of the American Builder Publishing Corporation.

EDITORIALS

Economies in Car Washing

Marked economies in the washing of passenger-train cars previous to painting or the making of heavy repairs have been accomplished on the Chicago, Milwaukee, St. Paul & Pacific, and no doubt on other roads, by the substitution of mechanical spray-washing methods for previous manual washing.

By the spray-washing method, a hot chemical solution is sprayed on the car interior or exterior from a suitable nozzle; the car is scrubbed to loosen the dirt, and water from a second hose is used to rinse off the dirt. Advantages of this system include the cleaning of relatively large surfaces with a great reduction in lost motion and savings of time and labor. All-steel express cars which, for example, were formerly washed inside and out in about 34 man-hours per car are now washed in 6 man-hours. Steel coaches, washed on the outside in 24 man-hours by hand, are washed by the spray method in 4 man-hours. In a test involving a total of 44 inside and outside car-washing jobs, 954 man-hours were required by the former hand method, as compared to 416 man-hours by the spray method, or a reduction of 12.23 man-hours per job. At an average cost of 57 cents per man-hour, the average saving per job was $6.97. This is for the car bodies alone and, when the saving due to the more rapid spray-washing of trucks is added, it is apparent that the spray method of car cleaning should receive the careful attention of car-department officers interested in the more satisfactory and more economical cleaning of passenger-car equipment.

Broad Shoulders And Thick Skins

Reduced forces, in many instances practically no force at all, plus depleted stocks in the storehouse, have not simplified the problems of the enginehouse foreman. One road says: "We are receiving many reports of engines found defective by I. C. C. inspectors and are also having a large number of engine failures due to defects existing and, in some instances, being reported by both enginemen and engine inspectors which should have been repaired prior to the engines being dispatched."

As is customary, and expected in most railroad organizations, the operating officers censure the mechanical department heads who in turn pass the "good word" along down to the enginehouse foremen. As a rule remarks conveying censure are not toned down in the process of transmittal. The enginehouse foreman generally has no choice but to "sit and take it." Practice in this operation has developed remarkably "broad shoulders" and a "thick skin" on most enginehouse foremen. There are, nevertheless, limits to the breadth and thickness, respectively, and the morale of the enginehouse foreman and his mechanics, who are loyally striving to do a job under extremely adverse conditions is at a low ebb. Right now these men need support from their immediate superiors, especially from attacks higher up. Camouflaging bad conditions by blaming them on "incompetent supervision," especially when there is no one to supervise, cannot help matters.

Heat Wastes In Power Plants

In the urge to take every possible step to prevent the waste of fuel, master mechanics, shop superintendents, and other mechanical-department officers who operate stationary steam boiler plants, should not forget that a dollar saved in power-plant fuel is worth just as much as one saved in locomotive fuel. In preparation for the coming winter season, therefore, when steam power requirements will be supplemented by the need for steam for heating purposes, the following are some of the places to look for the wastage of heat about steam boilers, according to an informative fuel-economy poster, recently issued by the Federation of British Industries:

(1) Unburned fuel in ashes. Avoid waste by cleaning fires carefully and by using suitable firebars. (2) Smoke and incompletely-burned gases. Avoid the production of black smoke and gases not completely burned by regular and frequent hand firing of coal in small quantities, or by proper adjustment of the stoker feed rate. Maintain the proper depth of fire. (3) Excessive draft. Regulate the draft by the dampers to reduce the excess air, endeavoring to obtain 12 per cent CO_2 in the chimney gases. (4) Holes in the fire. Keep the grates properly covered with a level fire, using the rake, when necessary, for this purpose. (5) Air leakage. Examine the boiler setting carefully for air leakage, particularly at furnace doors, cracks in the side walls, joints between the boiler shell and brick work and the damper slides. (6) Keep the boiler surfaces free from soot and flue dust. (7) Keep the internal boiler surfaces free from scale. (8) Do not force the boilers unnecessarily. (9) Examine the seating blocks and partition walls carefully, repairing, if necessary, to avoid by-passing the gases. (10) Lag the exposed surfaces of boilers and steam pipes effectively. (11) Avoid excessive blow-down. (12) Keep the boiler filled to the working level by a continuous and steady feed. (13) Avoid leakages of steam from boiler fittings and valves.

There is little question that considerable amounts of money are being wasted at individual railway power plants, owing, in many instances, to the use of obsolete and inadequate boiler equipment and accessories, much of which has not received the proper attention as to its maintenance. Decided improvements can, in many cases, be effected by attention to some of the details mentioned above, and it is particularly essential that periodical checks of boiler operation be made, using the necessary steam flowmeters, fuel and water measuring devices, CO_2 recorders, electric meters, ther-

mometers, and other equipment needed for an accurate knowledge of just what is being accomplished. Without this knowledge, it is difficult, if not impossible, to know exactly what part of the boiler equipment is functioning at less than the desired efficiency and needs attention.

Shop Use of Skids

The notable increase in the amount of material handled on skids at railway shops and engine terminals, particularly within the last year or two, has undoubtedly had an important effect in reducing costs. One large system uses at its shops, alone, 6 power lift trucks, 29 hand lift trucks, 902 flat skids, 11 tractors, 16 electric crane tractors and 135 tractor-trailers.

Skids are used for the collection of metal chips and borings in the shops which are subsequently dumped into the proper scrap car without the extra handling required when storage bins are used. Parts stripped from locomotives are placed in steel baskets, washed in lye, and moved on skids to the various shop departments for repairs, and back to the locomotive with a minimum of manual handling. Cylinders of oxygen and acetylene, formerly moved two at a time on a two-wheel truck by two men, are handled on a skid equipped with a rack which holds 12 cylinders, delivered to convenient locations in substantially less time than formerly required for handling two cylinders. Running boards, previously handled on two-wheel carts, are now moved about the shop in complete sets by tractor methods at a saving of 8 man-hours per locomotive. Cabs also are now handled on a skid equipped with a specially-constructed frame, mounted on a revolving plate, in 6 min., as compared with 30 min. by former methods. Another special skid which is a great labor-saver is designed to handle jacket iron, while standing edgewise on the skid between two hinged steel side frames, either one of which may be lowered for the ready placing of jacket iron sheets on the skid. Materials such as front-end netting, grates, cab fixtures, spring rigging, etc., are kept in sets in skid containers, readily available when required. Lagging is also similarly handled, to advantage.

Unquestionably, for certain materials used under special conditions, wheeled trailers are better suited than the less mobile skids, but the latter have their own peculiar advantages and, in general, can effect not only a substantial saving in labor, but can also contribute to safety, as well as order and cleanliness in shop operation.

Power Trucks at Shops and Enginehouses

Almost no single tool shows greater adaptability to a wide variety of railway operations and greater promise of economy than the various types of power trucks now on the market. In fact, a revolution in material-handling practices at railway locomotive shops, car shops, engine terminals, etc., has been going on for some time in the substitution of industrial tractors, crane trucks, lift trucks, and other trackless power for hand methods of moving materials. This equipment, where judiciously installed, has shown striking economies and not only reduced labor expense, but also speeded up material deliveries, reduced the time of equipment in shops undergoing repairs, and, hence, had a highly favorable effect on railway operating expense.

Steam locomotive repairs, which is one of the largest items of railway operating expense, is directly affected by material-handling methods. With the proper power tractor and truck equipment, not only are material deliveries from the store-room to the shop handled at reduced expense, but intershop deliveries are expedited and shop men do not have to interrupt their work to go out and get necessary materials. It is said that on the Canadian National, for example, two tractors save $1,400 per month in shop delivery work alone by relieving 3,600 man-hours for shop work. This is a conservative picture of the savings commonly reported where heavy materials are hauled considerable distances. On another road, tractors and trailers are estimated to save the mechanical department $5,000 a year at one shop in flue handling alone.

Car repairs represent a larger item of expense than locomotive repairs, and the same comments regarding the necessity for modern power truck and tractor equipment apply. Increased flexibility in material handling is attained and the use of skids permits moving lumber and other materials from the point of supply to the point of use with but a single handling. It is reported that on the Nashville, Chattanooga & St. Louis the operation of a single crane truck on car work effects a net saving of $1,000 yearly by handling mounted car wheels, steel center sills, bolsters, and trays loaded with scrap iron. In a car shop on another road, the extensive use of trailers and skids practically obviates the necessity of any car-building material touching the floor.

The economies of motorized operation in connection with scrap-handling work, where tractors and trailers can reduce the number of men required to pick up materials, are very striking. On the Chesapeake & Ohio, all scrap iron from one car-repair yard is moved by trailer directly to the scrap dock where most of it is dumped into cars for the market without further sorting. One lift truck, with suitable skids, on the Missouri Pacific is reported to have made possible the handling of reclamation plant material with 13 fewer men than when the truck was installed, three additional men being released subsequently. On the Chicago & North Western, the man-power required to move couplers from a steam hammer to the furnace and then to the assembly yards is said to be reduced in the ratio of 13 to 1 in favor of the lift truck over hand-trucking methods. In certain instances, lift-truck and tractor operation has released locomotive cranes and proved generally more satisfactory than traveling cranes or other fixed facilities.

Power trucks, particularly of the crane-equipped type, are a life saver in connection with engine-terminal work when making light repairs to locomotives and conditioning them for further service. The flexibility of these trucks in readily moving material to any place in the enginehouse and furnishing power to lift headlights, boiler fronts, rods, stokers, feedwater heaters, air pumps, etc., is an important asset. Adequate tractor and trailer equipment is also essential for economical enginehouse operation, it being reported that on one road a tractor saved between $500 and $600 a year in cleaning the engine pits alone, while at another point the time saved in this work has made it possible to reduce the labor force from eight men to four men at a saving of $3,700 a year.

Railroad men who are familiar with the way materials were handled at railway shops and engine terminals by "bull strength and awkwardness," not so many

years ago, appreciate the tremendous improvement already effected by power-truck and tractor installations but know that the railroads still have a long way to go before a saturation point is reached for the justifiable use of this type of equipment.

Expensive Economies

During the present business recession there has been a strong tendency for the railroads to undertake the manufacture in their own shops of replacement parts of a number of locomotive specialties, which, under normal conditions, have been purchased from the manufacturers. This has added to the list of things produced by the railroads many which they can not even produce of a quality to meet the requirements of the service for which they are intended and which, therefore, cannot be produced with true economy, no matter what a price comparison may indicate.

In the conduct of major shop operations required to repair locomotives, few of the refinements are called for which are essential to the success of industries devoting their attention exclusively to the production of specialized equipment. Tolerances are generally loose and unstandardized. Materials generally call for little special attention in the heating and machining operations to which they are subjected.

In the production of many specialties the conditions are entirely different. In the development of some of these special devices to their present high state of efficiency, durability and reliability years have been spent in evolving a selection of materials best suited to withstand the peculiar conditions of service to which they must be subjected in the functioning of the completed devices. In some cases ability to withstand excessively corrosive conditions has been the objective. In others it is the ability to withstand severe shocks under which ordinary materials fail repeatedly. In still others, materials to withstand seemingly insurmountable conditions of load or wear have been the object of research after a trial of all of the readily available materials had disclosed nothing adequate to meet the conditions.

Paralleling the search for materials to meet special conditions has been the development of a manufacturing technique which is no less exacting. In some cases alinement of bearings and interchangeability must meet tolerances measured in thousandths of an inch to insure reliability and efficiency in the functioning of the completed device. Such tolerances offer no particular difficulties in specialized manufacture and become a matter of everyday routine procedure. Back of this routine, however, are carefully designed tools, highly developed jigs, fixtures and templates and a system of rigid inspection.

Under the pressure of instructions to keep down purchases of materials and with men laid off and working short time, railway shop supervisors are severely tempted to undertake the manufacture of any spare part of any device which may require renewal, first, because they can under-bid the price of the commercial article by disregarding shop and overhead expenses, and, second, because they are able to provide additional man-hours, of which their employees are sorely in need.

They undertake these operations, however, with severe handicaps. First, they have no adequate knowledge of the kind of material required or of the specialized heat treatment, controlled within narrow limits, which may be necessary to develop the physical properties on which the successful performance of the repaired device depends. Second, where tolerances are close and interchangeability must be maintained, they lack the jigs, fixtures and templates without which the probability of keeping within tolerance limits is extremely remote; third, they are generally lacking in appreciation of the importance of finish. The absence or presence of a few insignificant tool marks may make all the difference between assured reliability and assured failure of a heavily loaded part of special steel.

Many railroad officers and supervisors are inclined not to take too seriously the insistence of the manufacturers of specialties that they be allowed to furnish renewal parts, assuming that the motive behind this insistence is the natural desire to increase revenues and profits, particularly at times when there is no demand for new equipment. That every company which manufactures replacement parts for its equipment has a selfish desire to secure as large a volume of replacement business as possible is, of course, obvious. What is not so obvious, however, is that behind the development of its repair-parts production program was the necessity to protect itself—and the railroads—against the too frequent failures of its equipment when renewal parts were made by the railroads.

Some railroads are paying dearly for an apparent economy in price by the short life of the home-made renewal parts and the unsatisfactory service of the devices of which they form a part.

NEW BOOKS

SPRINGS AND SUSPENSION. *By T. H. Sanders, M. I. Mech. E., M. I. & S. I. and M. I. Loco E. Published by The Locomotive Publishing Company, Ltd., 3 Amen Corner, London, E. C. 4, England. 520 pages, illustrated. Price 30 shillings.*

This is the second book of a series by Mr. Sanders. The first of the series, "Laminated Springs," published in 1923, dealt at length with the calculations, design, details and manufacture of the plate spring. In separate chapters of the second book, "Springs and Suspension," the author gives general ideas and details relative to the suspension of railway rolling stock, street-railway and highway vehicles, and special accessory springs. A third volume, by the same author, entitled "Springs—A Miscellany," which will deal with coiled springs, rubber springs, dynamic deflections, fatigue and spring testing, is contemplated to complete the series.

DICTIONARY OF WELDING TERMS. *Compiled by Fachausschuss fur Schweisstechnik beim Verein Deutscher Ingenieure, Berlin, Germany. 32 pages, 4 in. by 6 in. Paper bound. Price 1.80 reichmarks.*

In order to assist welding engineers in their endeavor to keep abreast of developments in the welding art through the reading of foreign technical literature, the Welding Committee of the Verein Deutscher Ingenieure has prepared this dictionary which translates into and out of English, German and Russian, respectively, many of the welding terms extensively used in these languages, but which, because of their newness, have not yet been included in standard technical dictionaries. The first section of the booklet translates German terms into English and Russian; the second section, English terms into German and Russian, and the third section, Russian terms into German and English.

THE READER'S PAGE

It Pays To Study Chill Worn Wheels

To the Editor:

The subject of chill-worn wheels is a live one at this particular time, more so than ever due to the high speed of our freight trains, rigid construction of cars, heavily loaded cars and heavy rails that reduce the absorption of vibration.

No better practice can be followed by an inspector than to be on the lookout for extreme vibration in car trucks, which is shown by worn bright oil-box bolts, oil-box lids, brake heads and hangers. When such defects are found it is necessary to examine the wheels thoroughly with a view of locating the cause of the vibration. It will invariably be found that the wheel has a flat worn-through-chill spot.

There are, of course, other wheel defects that cause undue vibration which are detrimental to a car, lading and road bed, such as eccentric wheels and wheels cast out of round. These defects are impossible to detect by ordinary car inspection and their discovery is up to the wheel shop. T. P. Schmidt.

Oil or Water?

To the Editor:

Have you any information about the relative advantages of water and oil as applied to engine-truck, tender and driving-wheel tires for the reduction or elimination of flange cutting? What I mean by the use of water, in this connection, is as a lubricant to reduce cutting as well as to wash sand off the rails.

Oil, placed on locomotive driving-wheel flanges to save wear, is not always successful, and, on this account, we have used water. The particular thing that I am seeking information about is whether the water causes excessive wear of the tire treads. Even without water, sand and grit will lodge on the faces of the brake shoes. The question is whether the running of water on the drivers will materially increase the wear of the treads on the theory that the water will cause more sand to lodge on the faces of the brake shoes than oil will.

My own opinion is that good results are obtained by the use of water. General Superintendent.

Hard Times Have Their Opportunities

To the Editor:

I am writing you a few lines to congratulate you on the fine make-up and generally interesting issues of the *Railway Mechanical Engineer*. With never a mention of the depression, you keep right on issuing a real monthly text book to us railroaders, which very fact implies a faith that good times will return and that we must keep on preparing ourselves for what will come with them.

Without making any lugubrious references at all (and you could be pardoned if you did), your message is an inspiration to take the present opportunity to overhaul some of our practices and analyze methods thought to be perfect. Temporary closings down are calamities indeed, if that is all they are considered. But, to the few who may be fortunate enough to be kept on, what a wonderful opportunity is offered to make these times the busiest ever experienced—times when, in the quieted plant, our experience is that so much can be discovered that was unsuspected and undiscovered amidst the hustle and whirl of keeping up the schedule. Now we are making the most of it.

Shop Superintendent.

Are You Overlooking This Point?

To the Editor:

Many bad-order freight cars which have A.R.A. defect cards attached covering damages to the car or for improper repairs made by foreign roads are stored in shop yards, and the time limit of the defect cards on many such cars are being overlooked. This limit is two years on cards covering damages and nine months on cards covering improper repairs. This means a considerable loss to the car owners. All cars when received at shop points and held for shop repairs, when found to have such defect cards attached, should have special handling through the shop and the defect cards removed and attached to the billing repair cards for collection. The same attention should be given to cars recommended for retirement when forms are sent in to the general offices, as A.R.A. Rule 94, paragraph 3, provides for the collection of certain material charges when cars are dismantled. W. H. Shiver.

Disagrees About Side Bearings

To the Editor:

A letter, signed by James McDonnell and appearing in the June issue of *Railway Mechanical Engineer* in reference to proper side bearing clearance is rather misleading. Mr. McDonnell states, "under no consideration should a truck have a flush side bearing, regardless of the fact that the other bearing may have the proper clearance," and further adds "A car with a flush side bearing is susceptible to derailment, especially when entering or leaving a curve."

I differ with Mr. McDonnell. The minimum side-bearing clearance, on cars equipped with metal body and truck bolsters, is $\frac{1}{16}$ in., to $\frac{1}{8}$ in. when the car is balanced on the center plate. The maximum clearance is $\frac{5}{16}$ in., when the car is so balanced. This clearance is between all four side bearings. Now suppose, due to a slight twist in the sills of the car or due to the truck bolster being slightly higher on one side than on the other, that the side bearing clearance on one side is double the minimum or double the maximum clearance with the opposite bearing flush, does Mr. McDonnell mean to infer that this car is not in safe condition for service? If so, let him go out into his train yard and see how many cars he can find that have equal clearance between all four side bearings and I believe he will find that the percentage is against his theory.

H. K. Allen.

With the
Car Foremen and Inspectors

A Machine For Cleaning Carpets

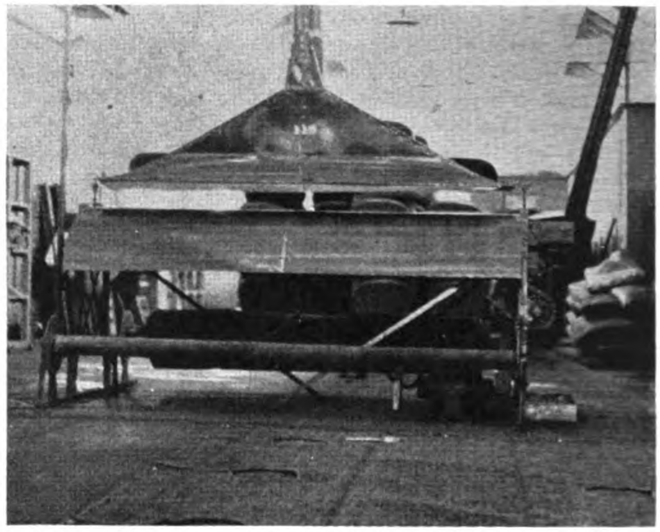
At the London car shops of the Canadian National a new carpet cleaning machine has recently been constructed.

The object in building this new machine was to replace the hand method formally used involving considerable labor and producing much objectionable dust. The carpets from coaches had been cleaned by spreading them on the floor or on a rack and blowing them from below with high pressure air at about 90 lb. pressure through a fan-shaped narrow slotted nozzle on a short piece of pipe in which was inserted a self-closing valve. The action of such a shaped nozzle gave a rapid vibrating action similar to a severe beating, which loosened up the dust and dirt blowing it up through the carpet. That which settled on the surface was blown off by passing the nozzle over the surface. Two men were usually employed in the cleaning. No provision was made for removing the dust away from the workmen.

It was felt that a better job could be done by a machine without so much labor and with means of removing the dust from interference with workmen. Such a device was designed as shown in Fig. 1, a photograph of the machine, and Fig 2, a drawing showing the details. The use of high-pressure air was continued for the cleaning but it was necessary to experiment with several different types of nozzles to obtain one that would give the best results.

Most carpet cleaning apparatus is bulky and an endeavor was made to keep the size of the machine as small as possible. To eliminate the troublesome dust it was decided to remove it at the point where it was created and carry it outside of the building so that the machine might be satisfactory for use in the upholstery room where carpets are repaired and some upholstered materials are stored.

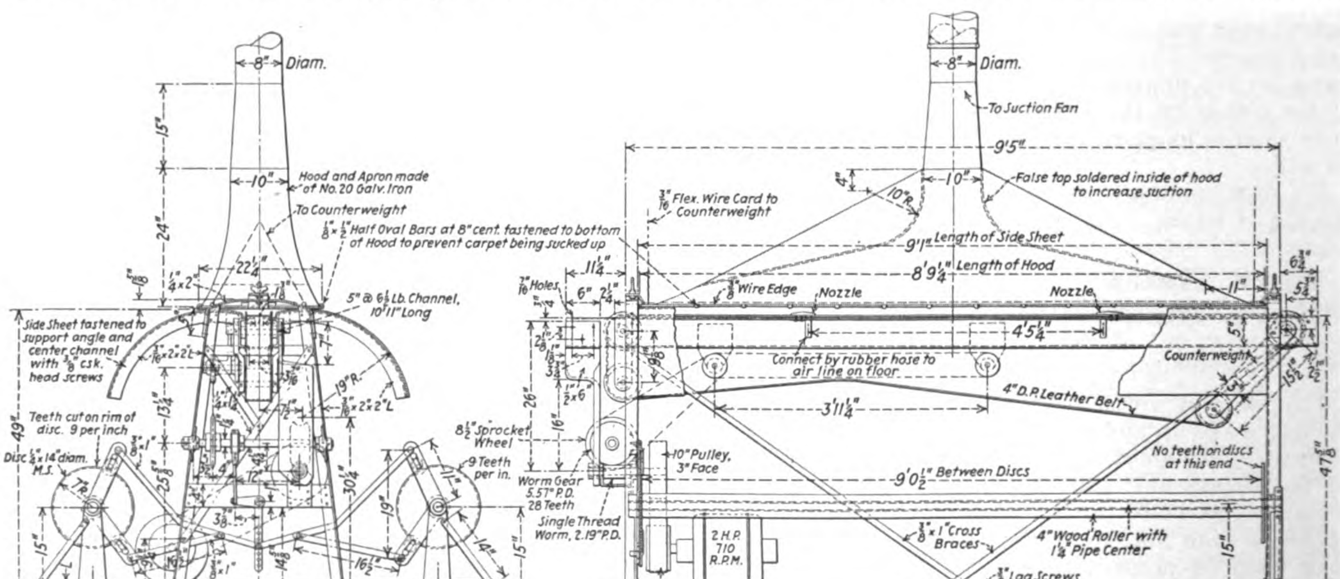
The machine was built of structural steel. It con-



A machine for cleaning carpets by compressed air

sisted of a semi-circular sheet-steel table divided at the highest point, which is about 4 ft. from the floor, in order to let the air nozzle pass through it and underneath the carpet. The table is 9 ft. 5 in. long, and 4 ft. wide at its lower edge.

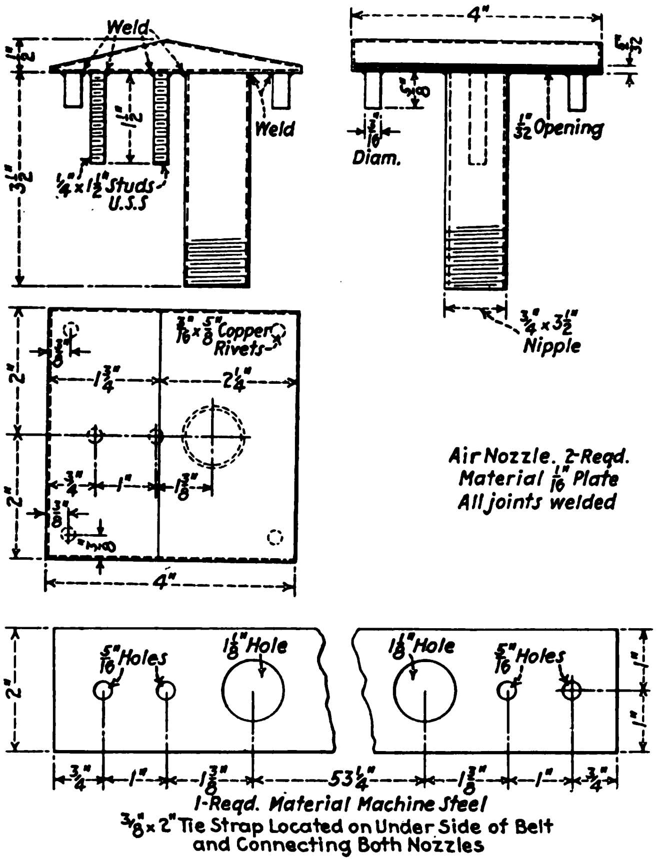
A roller the full length of the machine is located at each side of the apparatus on which to wind and



Once attached the carpet is moved through the machine and cleaned without further attention

unwind the carpet as it is being cleaned. On one end of each roller there is a notched wheel. By means of a small ratchet which can be thrown into or out of contact with the notched wheel and which is connected through a series of levers to an eccentric motion actuated from the driving motor, first one roller and then the other roller may be thrown into action so that the carpet can be drawn in either direction over the table by manipulating the ratchets. In order to allow the end of the carpet to come to the middle of the table and over the cleaning nozzle a piece of canvas is fastened to each roller long enough to reach the middle of the table. The end of the canvas is equipped with eyelets and strong cord is used to tie the end of the carpet to the end of the canvas through eyelets usually found in these carpets. Where the carpets are not equipped with eyelets a single loop is put through the carpet with a carpet needle and tied to the canvas.

Many railway coach carpets are split and cut out



The air nozzles are of special design

at spots to fit around the legs of seats. In such cases they are tied together at these points by a single loop of cord applied by a needle when they are being placed on the machine. This prevents any of the free ends from moving away from the high pressure when passing over the nozzle. Only a few loops or stitches are necessary so that the labor required is small and can be done as the carpet is being rolled up on the first roller.

After the carpet is fastened to the canvas on one roller and rolled up, the other end is fastened to the canvas on the other roller; the carpet is then ready for cleaning and can be made to pass in either direction over the air nozzle by manipulating the ratchets above mentioned.

One 2-hp. motor is used to drive the mechanism, moving the air nozzle to and fro as well as winding up the carpet on the rollers.

Having fastened the carpet to the rollers the air is turned on and with the motor in operation the carpet moves slowly over the nozzles and the dust and dirt is blown out. Above the table is an adjustable hood, shown in Fig. 1, the full length of the table which is connected by an 8-in. duct to an exhaust fan used for other purposes in the same room. This fan carries the dust away, as it is blown out of the carpet to the outside of the building. This hood can be adjusted down as close to the carpet as necessary to collect up all the dust.

Trials With Different Nozzles

Several different types of nozzles were experimented with. First a piece of ¾-in. pipe with a series of 1/16 in. hole was tried, but this used so much air that it affected the pressure in the shop and also blew considerable dust out into the room from the sides of the carpet. Two flat nozzles with openings 4 in. by 1/32 in. were next tried out. These were directed vertically and were driven by an endless chain, shown in Fig. 2 so that each nozzle moved to and fro half way across the table. This arrangement was satisfactory with respect to the quantity of air used, but the vibrating action was not sufficient and much dust was blown out from the sides of the carpet into the room as the nozzles came near the ends of their strokes.

Two nozzles were then designed as shown in Fig. 3. The air openings were the same size as in the previous case but instead of being directed vertically the nozzles were placed so that the air was directed along the surface parallel to the carpet and the openings both pointed towards the centre of the table. These nozzles were bolted to an endless rubber belt which bridged the gap between the two sections of the table. This belt was given a to-and-fro motion half way across the table by being fastened to the endless chain shown in Fig. 2. The carpet vibrated very rapidly in front of the nozzles, by rubber hose.

This type of nozzle gave very satisfactory operation. The carpet vibrated very rapidly in front of the nozzles, while behind them a slight vacuum was created which held the carpet down to the table and the belt. This permitted the air to pass up through the carpet, carrying the dirt and dust loosened by the vibration so that it could be picked up by the exhaust fan and carried outside the building. The vacuum behind the nozzles prevented any dust from being blown out around the back of the nozzles into the room at the ends of the stroke.

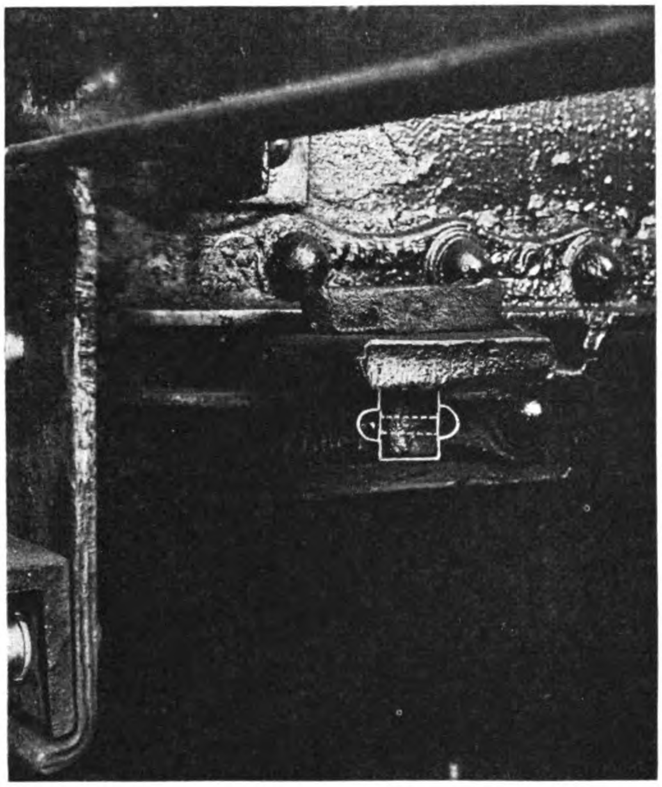
As the table is about four feet from the floor it makes a convenient location for marking the carpets where sections must be cut out for repairing or for scraping off gum or other materials that cannot be blown out.

The superiority of the cleaning over the hand method may be judged by the fact that carpet needles which had to be very frequently renewed on account of becoming blunt can now be used many times as long. Also a much better job of reconditioning with dies, etc., can now be made. The cost of the labor for cleaning is greatly reduced, it being unnecessary for anyone to stand by the machine while it is cleaning. The direction of the movement of the carpet has only to be reversed or the machine stopped as the end is reached. If the carpet is exceptionally dirty, it is passed through the second time. The machine can be varied in speed. The maximum speed requires about twenty minutes for the average length of carpet.

Draft-Key Retainers Held by Rivets

SO much trouble was experienced by an eastern railroad with cotter keys losing out of the A. R. A. draft-key retainers that the application of rivets was adopted.

As all system cars go through the shops for rebuilding or pass over light repair tracks, the cotter keys are



A soft rivet instead of a cotter increases the security of the draft-key retainers

removed and a soft rivet is applied. This rivet, if properly applied, will not lose out and requires no further attention, as does the cotter.

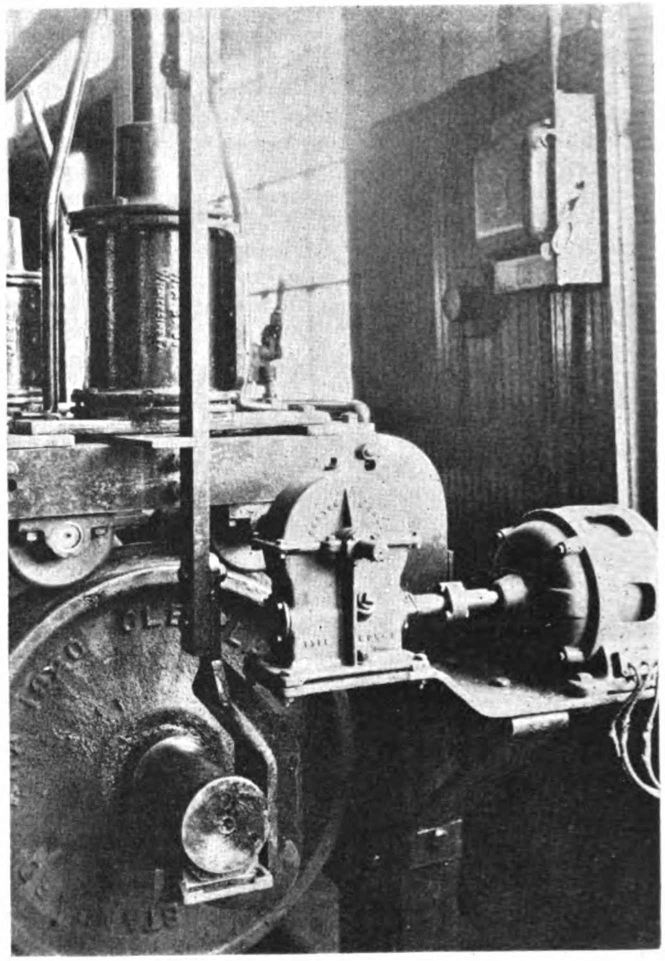
Should it become necessary to remove the draft-key retainer the rivet can easily be removed with a hand hammer and chisel.

While the application of these rivets has only been in effect for one year, the results have been most gratifying.

Device for Wearing-In Journal Bearings

SOME time ago the *Railway Mechanical Engineer* published a short article describing a device for wearing-in journal bearings on car and tender journals. It was operated by an air motor and the brass was held against the journal by spring pressure.

The device shown in the accompanying illustration is electrically operated and shows the car wheel being raised up against the driving wheels with the full weight of the wheels and journal on the brass together with added weight occasioned by the air pressure used to lift the wheels. Two standard journal wedges are welded to the lifting arms and to these the brasses are applied



The full weight of the wheels rests on the journal bearing

before the wheel is lifted against the two driving wheels. The drive rollers are mounted on a single shaft and cause the wheels to rotate by bearing on the tread.

This device is helpful in reducing the number of hot boxes resulting from wheel renewals as the journal bearing is already worn in to a perfect seat on the journal before the car is put in service.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Conditioning Tank Cars for Loading Chargeable to Owner

Keith Tank Line cars are used by shippers of cocoanut oil for the transportation of this lading from Portland, Ore., to points east. On account of requests by the shippers the Spokane, Portland & Seattle has made it its practice to clean and inspect all tank cars destined for cocoanut-oil loading at Vancouver, Wash., while en route to Portland. The Keith Railway Equipment Company questioned the authority of the S. P. & S. to remove dome covers and make any inspection or repairs to interiors or interior fittings of Keith tank cars with-

out being requested to do so, and also the right of the railroad to determine if such repairs were necessary and to bill the car owner. The tank-car company in its appeal to the Arbitration Committee listed 26 specific cases, the bills in each case amounting to from $1.20 to $17.85. The car owner pointed out that all Keith tank cars destined for cocoanut-oil lading were inspected and repaired at its plant at Chicago previous to being moved to Portland. Any cars found in unsuitable condition were immediately repaired at its car shop. It cited two cars which had been thoroughly overhauled, cleaned down to the steel, discharge valves ground in and tested, and forwarded directly to Portland. Nevertheless the railroad cleaned these cars at Vancouver and also ground in the discharge valves. The owner declined to pay the charges listed by the railroad, claiming that the work performed was unnecessary and also pointed out that in its opinion it was better able to place the cars in condition for such shipments than the railroad. The railroad in its statement pointed out that when it first started handling these oils the cars were forwarded direct to the loading plants at Portland. These plants tested all tank cars before loading and in many instances cars were found unfit for loading because of being dirty or having defective heater coils or leaking discharge valves. This made it necessary to haul these cars from Portland to the railroad's shops at Vancouver, a distance of approximately ten miles. This haul included crossing two drawbridges over the Columbia and Willamette Rivers. As a result of this experience the railroad stopped all tank cars in this service at Vancouver for inspection and repairs to avoid the expensive back-haul, delay to shipments and extra switching charges. The railroad submitted with its statement a letter from one of the large shippers of cocoanut oil to the effect that it was imperative that tank cars destined for the shipments of that company's products should be thoroughly cleaned before each loading. The railroad also contended that its charges were authorized by Rule. 16.

The following decision was rendered by the Arbitration Committee on April 10, 1931: "Under Rule 16 the repairs made by the Spokane, Portland & Seattle are properly chargeable to car owner."—*Case No. 1676, Keith Railway Equipment Company vs. Spokane, Portland & Seattle.*

Failure of Weak Draft Arms Drops Underframe on Ties

Union Pacific automobile car No. 171292 was damaged on the Chicago, Rock Island & Pacific near Kremlin, Okla., August 11, 1930. This damage was reported to the car owner under Rule 112 as "destroyed." This report was subsequently withdrawn by the Rock Island and a joint inspection was furnished and the car was reported for disposition under Rule 120. The train, of which this car was a part, was running at approximately 40 m.p.h on a descending grade. The engineman made a 10-lb. brake-pipe reduction to reduce speed when the car failed because of old fractures in the two cast-steel draft arms on the B end. The end of the car, including the body bolster, pulled away from the underframe, allowing the underframe to clear the truck and drop down on the ties. Both trucks remained on the rails. A joint inspection was arranged at the time the car body lay on the right-of-way at the foot of a 10-ft. embankment, having been turned over by a wrecker to clear the tracks. The trucks had been picked up and taken to El Reno, Okla. The superstructure of the car, with the exception of the steel ends, was entirely demolished. The Bettendorf draft arms which were riveted to the single steel center sill showed old breaks immediately back of the body bolster. The Z-bar side sills were also broken over the body bolster. Examination of the track showed that the ties were scored for a considerable distance by the dragging center sill. Both railroads agreed that the failure of the draft arms was responsible for the accident. The Union Pacific declined to authorize repairs, but it did authorize, within the prescribed 30 days, the dismantling of the car, pending a definite conclusion as to the question of responsibility. The Rock Island contended that, with the exception of the damage caused by the car being turned over by the wrecker, there were no Rule-32 conditions involved and that the owner was responsible for the damage caused by the failure of the two side sills, draft arms, two side plates, and all related work incident to the repairing of these parts. It amended its claim by acknowledging responsibility for the additional damage resulting from turning the car over to clear the main line. This meant, it was claimed by the Union Pacific, that the car owner would be assessed with practically all the damage which resulted directly from the car being demolished by the wrecker. The Rock Island claimed that Arbitration Case No. 1638 was similar to the circumstances of this accident, while the Union Pacific was of the opinion that Cases Nos. 1186, 1236, 1342, 1346, 1419, and 1487 were similar, and that the car should be settled for as destroyed, under Rule 112.

The Arbitration Committee rendered the following decision: "The evidence does not indicate that the car was subjected to unfair usage within the intent of Rule 32. Therefore, the owner is responsible for the failure of the car. However, handling line is responsible for that portion of the damage incurred by turning the car over to clear the main line."—*Case No. 1677, Chicago, Rock Island & Pacific vs. Union Pacific.*

Substitution of 12¼-In. for 9¼-In. Coupler—Improper Repairs

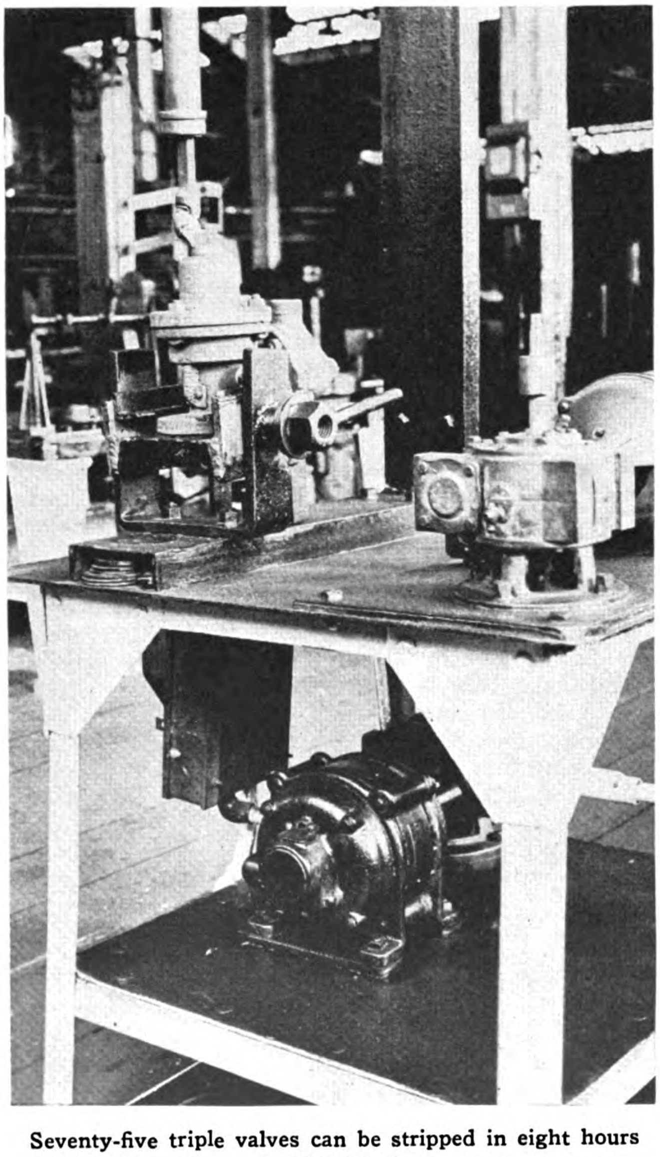
On June 23, 1929, the Atlanta, Birmingham & Coast applied a new temporary A. R. A. standard coupler with 5-in. by 5-in. shank and 12½-in. head to Seaboard Air Line car No. 82506, in place of a 5-in. by 5-in. by 9¼-in. coupler, on account of the butt being broken. The stenciling was changed by the A. B. & C. to show the 5-in. by 5-in. by 12¼-in. coupler as being standard to the car. A charge was made for the new coupler, credit being allowed for the defective A. R. A. standard 5-in. by 5-in. by 9¼-in. coupler. The owner contended that the A. B. & C. had no authority to apply a 12¼-in. coupler and to change the stenciling to show this size coupler as being standard to the car, and that this substitution constituted wrong repairs. Cancellation of the charge was requested because of the failure of the repairing line to issue a defect card at the time repairs were made. The Seaboard Air Line contended that Arbitration Decision 932 covered a parallel case and contended that the entire charge should be cancelled in accordance with Interpretation 4 of Rule 87. The A. B. & C. claimed that wrong repairs were not made, as Paragraph C of Rule 17 states that the dimensions of the shank and butt must be maintained, but does not mention the coupler head. It also pointed out that the car was stencilled only "5-in. by 5-in. shank coupler" and that the stenciling did not show the size of head standard to the car. It also claimed that Rule 88 permits the repairing line to use material from stock in order to expedite repairs to foreign equipment, in-

stead of ordering special material, not specified in the last paragraph of Rule 122, from the car owner. The A. B. & C. also claimed that if within the intent of the rule wrong repairs had been made the owner should have obtained a joint evidence in accordance with Rule 12 and corrected the wrong repairs within the time limit prescribed and requested a defect car from the repairing line.

The Arbitration Committee rendered the following decision: "The temporary M. C. B. standard coupler was designed for use of car owners until such time as permanent end clearance in certain types of construction could be provided. It was not intended for application to foreign cars unless so stenciled. Therefore, the substitution constituted wrong repairs. The contention of car owner is sustained."—*Case No. 1678, Seaboard Air Line vs. Atlanta, Birmingham & Coast.*

Handy Stripping Bench In Triple-Valve Shop

THE stripping bench shown in the illustration, while only 4 ft. square is sufficiently large to take care of the stripping of from 75 to 80 triple valves each



Seventy-five triple valves can be stripped in eight hours on this bench

eight hours, including the grinding in of the check-case seats.

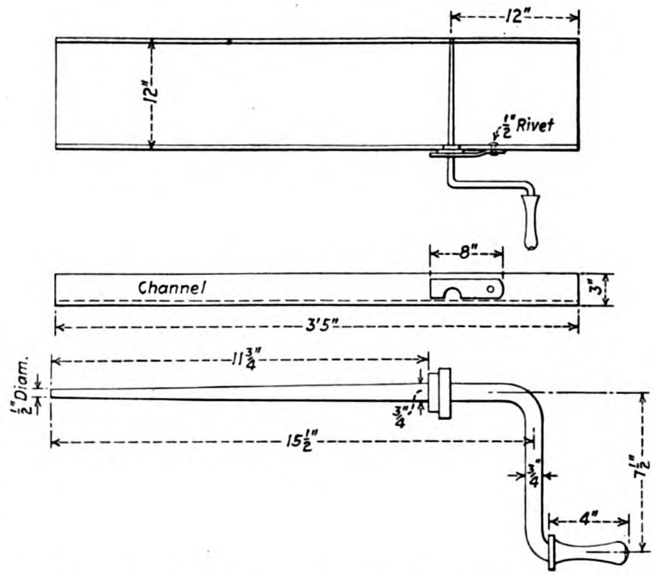
The triple valve is placed in the adjustable vise shown on the left side of the bench and all of the nuts are removed with a socket wrench equipped with toggle joints and located just over the vise. This wrench is electrically driven, and the speed is controlled by reduction gears. In addition to the toggle joints, which permit flexibility, a hollow tube or section of pipe is located just above the joints which allows the operator to raise or lower the socket wrench a distance of 12 in. Power for the operation of the wrench is controlled by a foot treadle permitting instantaneous starting or stopping.

At the right of the table is located an electrically driven grinder. Various sizes of grinding discs can be applied for grinding the seats of check cases at the same time that the operator is stripping the triple valve.

Device for Forming Back Rolls in Journal Boxes

REGARDLESS of the methods employed in the manufacture of back rolls for use in packing journal boxes the rolls must conform to the size as given in A. R. A. Rule 66. When rolls are spun on a spindle, Rule 66 permits the elimination of 3-ply jute, flax, or "mail" twine for tying the roll.

An ideal spindle for the manufacture of back rolls can be made as shown in the sketch. A section of 12



Drawing showing details of the tool for making back rolls

in. channel of any length desired can be used for the trough. A spindle ¾-in. in diameter and tapered down to ½-in. at the extreme end is inserted in the side of the channel about 12 in. from the end. This is held in place by a latch secured to the side of the channel which fits over the sleeve which is welded or forged 11¾ in., from the tapered end of the spindle. This latch is attached to the side of the channel with a ½-in. loose fitting rivet or bolt and permits the latch to be raised or lowered to apply or remove the spindle.

Back rolls can be formed on this device with either dry or saturated packing. If dry packing is used, the rolls must be soaked in car oil before they can be used.

However, saturated packing can be used just as efficiently and when rolls are thus formed they are ready for immediate use. If saturated packing is used it is recommended that a number of 3/8-in. holes be drilled through the bottom of the channel, directly under the spindle, to permit oil to drain into a receptacle, which should be placed under it for that purpose.

Floor Furnace And Nozzle Valve

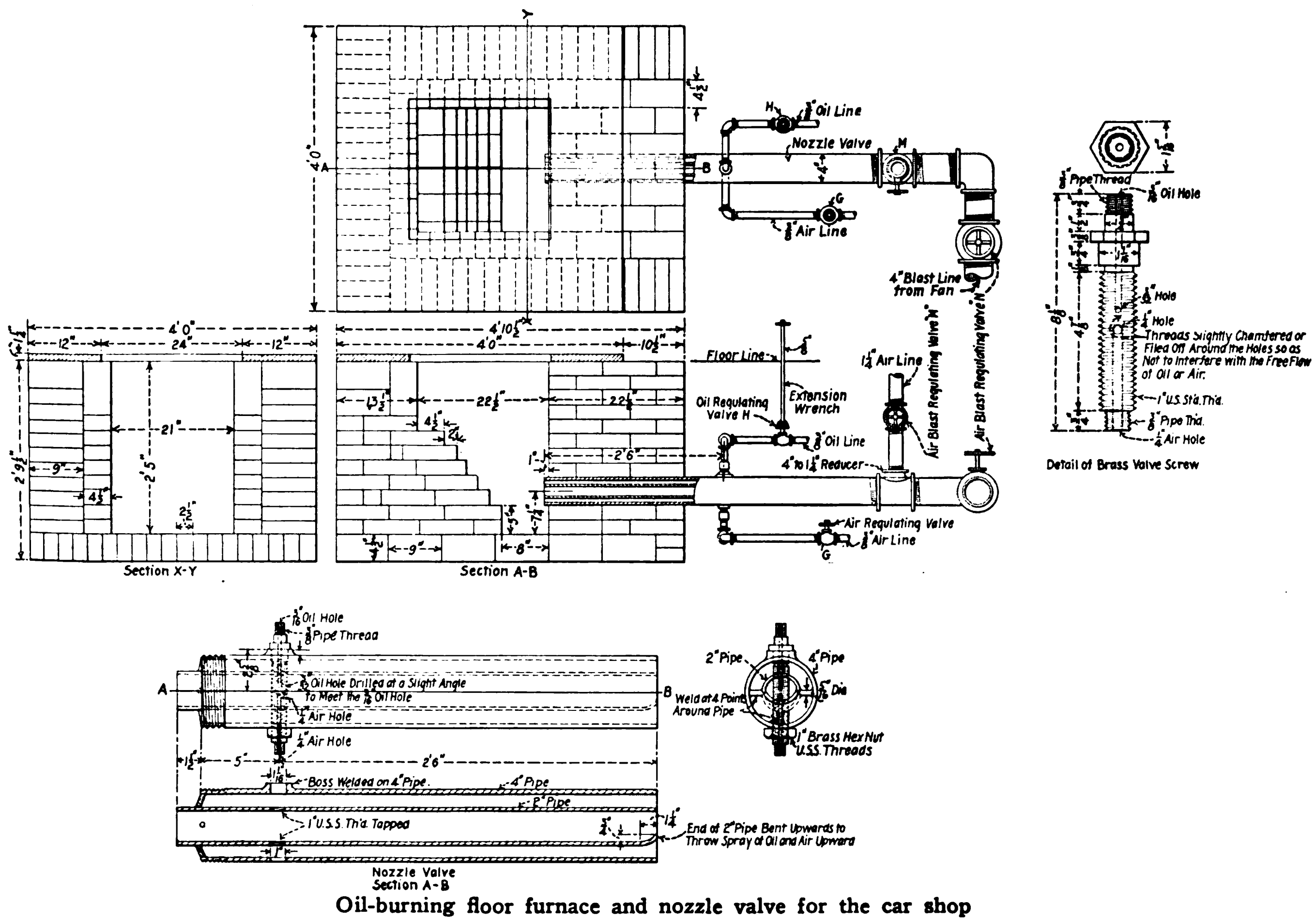
THE oil-burning floor furnace and nozzle valve shown in the drawing is used in the forge shop of the car department of an eastern road. The piping is laid in a trench which is covered with an iron grating or with planks. Extension wrenches, such as that applied to the oil-regulating valve *H*, are attached to all valves located in a trench for convenience of operation. Valves *G* and *H* regulate the supply of air and fuel oil, respectively. The valve *N*, in the 4-in. blast line, regulates the blast from the fan.

The nozzle consists of 4-in. and 2-in. pipe, the smaller pipe being placed inside the larger, as shown. The 2-in. pipe is held in position by four welded ribs at the threaded end as shown in section *A-B*. The welded ribs are approximately 5/16 in. in diameter and are equally spaced around the pipe.

The nozzle valve is used on practically all of the oil-burning furnaces installed in the car shops on the railroad, and can be applied to nozzle pipe of various size by changing the valve dimensions to suit. The threads of the valve screw are slightly chamfered or filed off around the holes so as not to interfere with the free flow of oil or air. Oil is forced through a 3/32-in. hole from the top of the valve and air enters the nozzle through a 1/4-in. hole from the bottom end. The oil and air are thoroughly mixed by the action of the air from the blast fan.

It will be noted that the lower end of the 2-in. nozzle pipe is bent upward to deflect the spray of oil and air upward against the bricks which are built in a series of steps to further assist the upward deflection. The furnace is constructed with Munro 9-in. by 4½-in. by 2½-in. firebrick. The top of the furnace is protected by a 1/4-in. plate, as shown, to prevent damage to bricks when work is laid on top of the furnace to be heated.

An Articulated Locomotive Contest.—In a recently published volume entitled "Articulated Locomotives," Professor Lionel Wiener describes a contest held at Semmering (Austria) in 1851 to determine which of the articulated locomotive systems then available would be likely to give the greatest satisfaction under the very difficult conditions prevailing on the Semmering Railway. The conditions to be met were that the locomotive should be able to draw trains of 140 tons up a grade of 2½ per cent at a speed of 7½ miles an hour. The boiler pressure was not to exceed 121 lb. per sq. in. and the axle load was limited to less than 14 tons. On one section of a little more than 23 miles, grade reaching 2½ per cent were encountered, one of them having a length of 1½ miles. The minimum radius of curvature was 623 ft., except on the grades, where it was 935 ft. In 1850 the Austrian Ministry of Commerce and Public Works issued an invitation for designs of locomotives capable of dealing with the traffic on the section, and a monetary prize was offered for the best locomotive performance. This prize amounting to 240,000 francs, was awarded to the locomotive bearing the name *Bavaria*, built by Maffei of Munich. This engine was equipped with three trucks or groups of wheels, and transmission was effected by chains. Its weight in working order was 68.3 tons.—Railway Gazette.

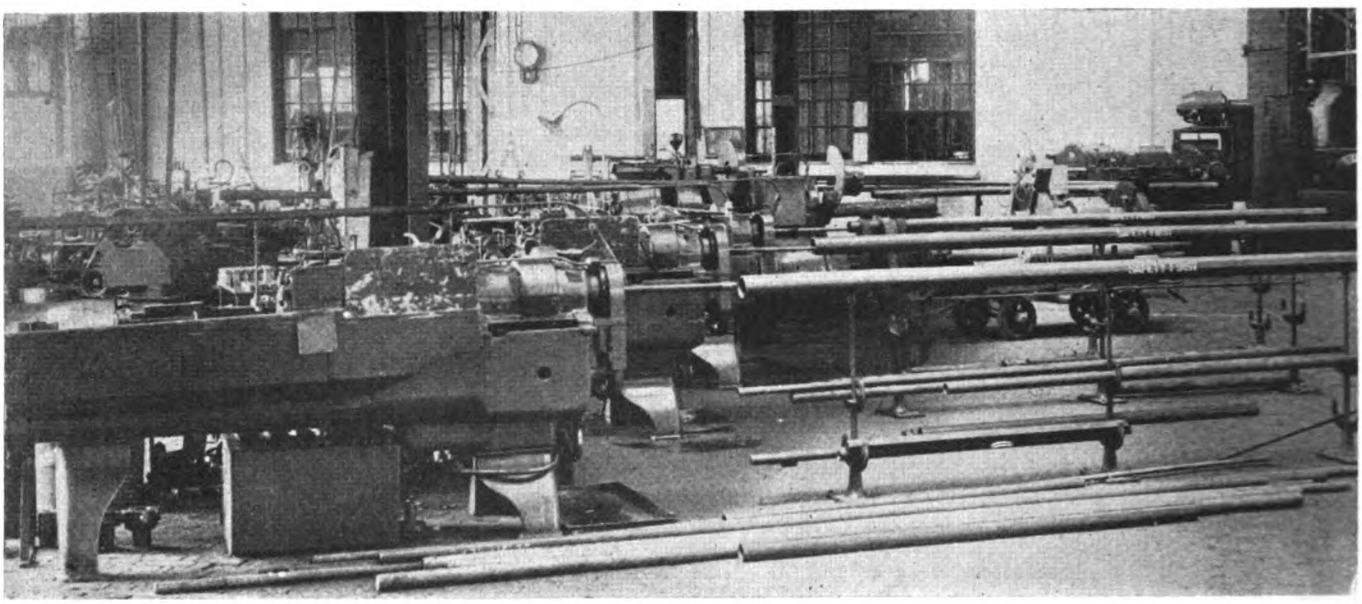


Oil-burning floor furnace and nozzle valve for the car shop

In the Back Shop and Enginehouse

Machine Placement And Production

THERE is a definite relation between the location of railway shop machinery and the production secured from machine-tool equipment, this statement applying equally well in almost any department. Take, for example, the small machinery bay illustrated. As originally installed, all machinery in this section of the shop was placed parallel with the windows. Relocating the machines diagonally, as illustrated, had the result of conserving floor space and, what is perhaps more important, placing the machines at such an angle with the windows as to permit light to fall on the work where it will be most effective without casting shadows. At the time when this picture was taken the heavy machinery bay at the left had been painted with aluminum paint, greatly improving the lighting conditions in the interior of the shop. When this treatment with aluminum paint was given to the posts, steel beams and supporting timbers and ceiling of the small machinery bay a lighting condition was obtained which approximated



A battery of turret lathes in a carefully laid out bolt-manu facturing department

Diagonal placement of machines conserves floor space and gives correct light angle

a northern lighting effect without glare. Accuracy, safety, and increased production are attributed to the improved lighting conditions which resulted.

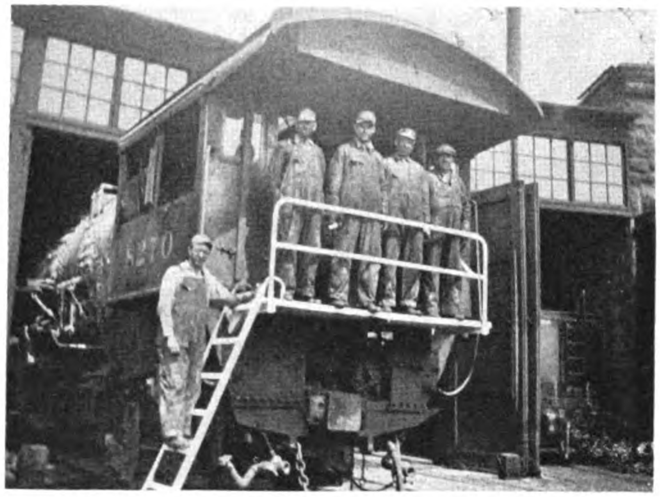
Similar treatment was given to the turret-lathe equipment in the southeast corner of the same shop. This machinery includes turret lathes and an automatic stud machine, etc., set diagonally in this case not only to conserve space, but to permit handling full length stock and to centralize supervision. As a result of the improved lighting conditions and better supervision, the production in this department of the locomotive shop was increased substantially and unit costs proportionately reduced. While the actual production secured varies somewhat and depends upon demand, an average time for some of the most commonly used parts manufactured on a production basis is as follows: Cylinder head studs, 3 min. each; boiler studs, 4 min. each; taper-head radial staybolts, 3 min. each. In addition, guide bolts, studs, special pins and frame bolts are roughed out and semi-finished at a highly desirable production rate as compared to that in inadequately-equipped and poorly-lighted bolt departments.

A Cab Safety Platform

A CAB safety platform, notable for light weight and strength, as well as ease of application, has been developed at the Terre Haute (Ind.) enginehouse of the Chicago, Milwaukee, St. Paul & Pacific. This platform is of welded tubular steel construction, designed to be firmly attached to the cab of a locomotive undergoing repairs in a back shop or enginehouse after removal of the tender. It affords an easy and safe entrance to the cab, also making more working space available at the level of the cab floor.

The general construction and details of the platform are shown in the illustrations. Referring to the assembly drawing, it will be observed that the platform and cab rails are carried on two horizontal main supports of 5/8-in. by 2 1/2-in. steel, which extend through the cab waste sheet and are secured on the inner side by taper keys. The platform itself consists of three oak boards, 1 1/2 in. by 8 in. by 8 ft., held together by 1 1/4-in. angle-iron cross braces and carriage bolts. The outer angle irons are located just inside the horizontal supports so as to prevent undesirable end movement of the platform.

The outer ends of the main platform supports carry two vertical 1 1/4-in. by 5-in. pipe nipples, welded in

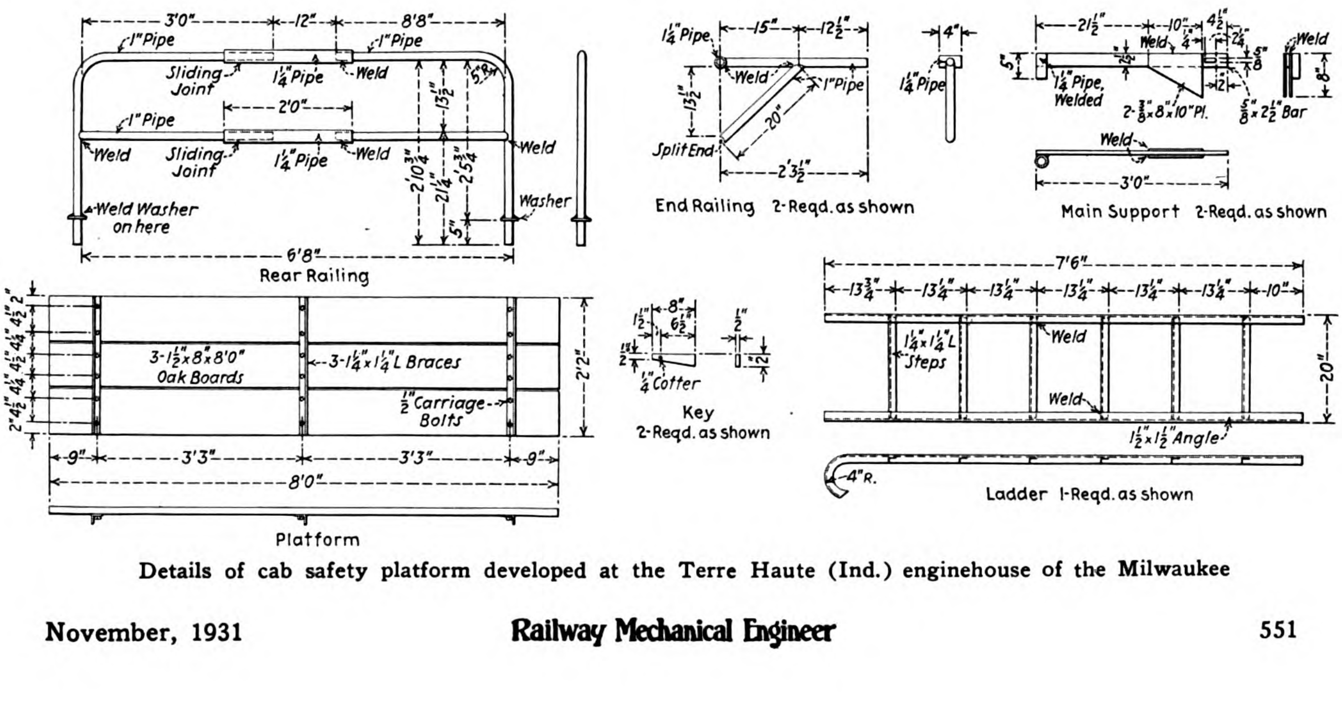


The cab safety platform and ladder supporting five men

place, which receive and support the vertical members of the double-bar rear railing. This rear guard railing is made of 1-in. pipe, bent and welded together. Suitable washers, welded in place, serve to prevent the vertical members of the rear railing from dropping more than 5 in. into the 1 1/4-in. main support nipples. Sliding joints are provided at the center of the double-bar rear railing by means of two long 1 1/4-in. pipe nipples, welded at one end. An end railing, provided on one or both sides of the platform, as desired, consists simply of a piece of 1-in. pipe, welded to a 1 1/4-in. by 5-in. pipe nipple, moving freely on the upper bar, with a diagonal pipe brace bearing on the lower bar. The end railing can be readily swung back out of the way when not needed on the side on which the ladder is being used.

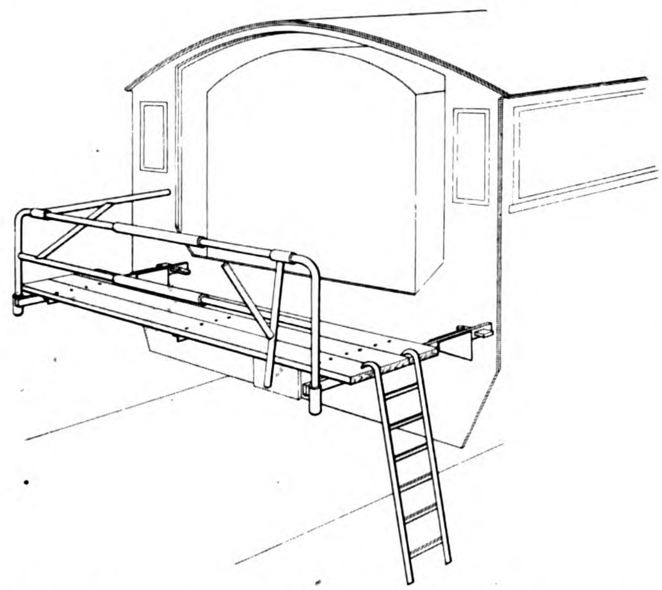
The ladder consists of welded angle-iron construction, which is light in weight and rigid. The ladder sides are bent at the top in the form of a half circle to hook over the platform. The ladder simply rests against the platform and serves in no way to support it.

This safety platform is constructed from second-hand material at small cost. It comprises essentially two main supports, a platform, a ladder, and rear and



Details of cab safety platform developed at the Terre Haute (Ind.) enginehouse of the Milwaukee

end guard railings in two pieces, any one of which can be readily handled by one man. Owing to this construction, which makes all parts relatively light in



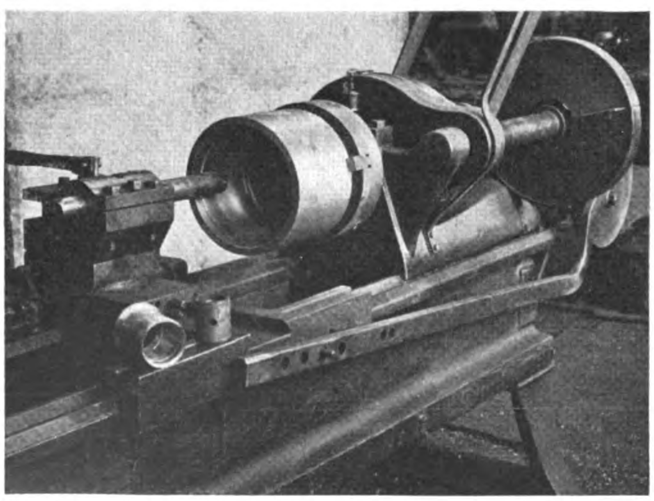
General arrangement of light but strong cab safety platform

weight, one man can apply or remove the safety platform readily without assistance except possibly in lifting the platform into place.

Attachment for Cutting Oil Grooves in Bushings

WITH the demand for more efficient lubrication of moving parts on present-day locomotives, it becomes necessary to develop a better method of grooving motion work and rod bushings. A practical device which has been in use at Silvis (Ill.) shops of the Chicago, Rock Island & Pacific for some time was designed and applied by J. C. H. Pauls, foreman.

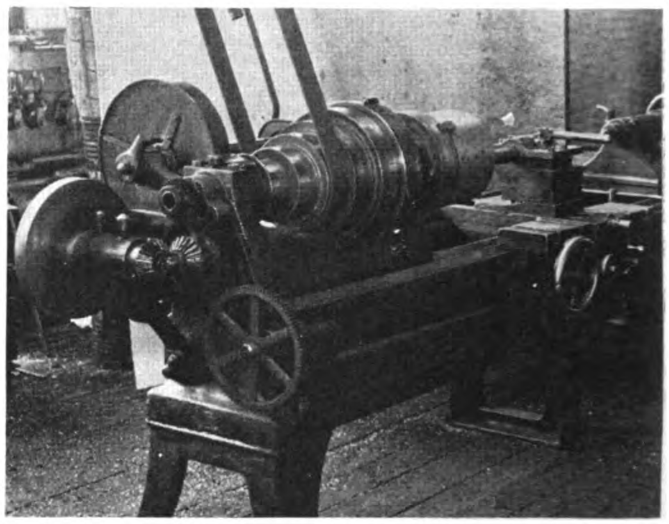
The old method of lubricating a bushing was to drill a hole through the bushing at the top center. On the smaller bushings, this was the only provision made, while on the larger ones a groove was chipped each way from the hole and in a straight line along the bore of the bushing. In many cases, the lubricant did not



Rear view of lathe equipped with oil-grooving attachment

travel to the outer edges, and the result was that only the center portion of the pin was lubricated. This caused excessive wear and in some cases caused failure and increased loss in maintenance.

With the improved method, these difficulties have been overcome, resulting in a saving of both material and time. The present groove is shaped like a figure eight. The oil hole is drilled at the intersection of the two circular grooves. The one circular groove starts at the top and center and advances to the outer edge as it continues to the bottom of the bushing, and as it comes to the top on the reverse side it intersects at the oil hole and continues the second circle on the opposite side in the same manner. When the lubricant enters through the oil hole at the intersection of the two circular grooves, it meets with no resistance as the grooves follow a downward path advancing to the outer edges of the bushing. This feature assures more satisfactory lubrication as it distributes the lubricant over the entire length of the pin. The grooves vary in size from 1/8 in. to 1/2 in. in width, and from 1/32 in. to 1/8 in. in depth, according to the size of the bushing. This method of



End gearing used to give the proper pitman and carriage movement

grooving is used both on brass and steel bushings. Grooves can be machined on either the inside or outside of the bushing.

This attachment was designed as a separate unit so that it can be disengaged easily, and the engine lathe to which it is attached can be used for its regular line of work. The 32-tooth spindle gear remained intact; next a 64-tooth change gear was selected and a 32-tooth mitre gear which was mounted and keyed to the changed-gear shaft. To engage another 22-tooth mitre gear and at right angles to the spindle, a bearing was applied to the end of the lathe and toward the rear of the machine. In this bearing, the crank is mounted, having the second mitre gear on one end and a 14-in. disc on the other end which acts as a crank. The disc end of the crank has a 6-in. slot extending from the center toward the outer edge in which a step body bolt is inserted to provide for adjustment. The motion from this crank is transmitted to the carriage by means of a long pitman which has a series of holes in the carriage end and slips over a pin at the rear of the carriage. The tool post is equipped with a boring-bar holder, and a bar with a single round-nose tool for cutting the groove. The bushings are held in a universal 3-jaw chuck.

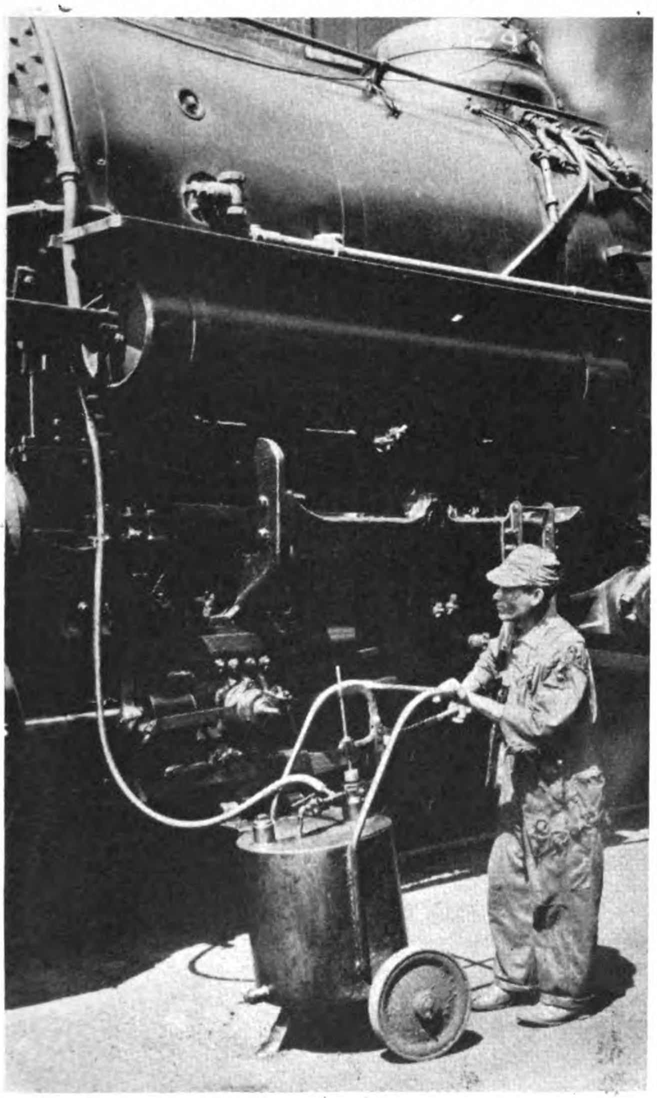
When operating the lathe, the bushing makes two revolutions as against one movement of the carriage holding the tool, forward and back. This is controlled by the 2-to-1 ratio of the spindle and change gear, while the amount of the carriage travel is controlled by the adjustment of the crank, by means of the slot. The crank end of the Pitman is set off center slightly less than one-half the width of the bushing so that the grooves will come near the outer edge at the bottom of the bushing.

The time required to do this grooving operation varies from two to four minutes, depending on the size of the bushing and the depth of the groove. With this nominal expense involved for grooving, a more efficient system of lubrication has resulted with a great saving in maintenance costs.

This article is published through the courtesy of the Rock Island Employees' Magazine.

Mechanical Lubricator Filler

PARTICULAR attention is paid at the Illinois Central enginehouse, Centralia, Ill., to provide, as far as possible, every assistance and mechanical facility required for the expeditious turning of power and conditioning it for further service. All of the operations on the receiving and delivery tracks have been studied and the work organized to eliminate lost motion as far as possible. One of the details receiving special attention is the supply of oil to flange lubricators and mechanical lubricators. As soon as a locomotive is received at the Centralia terminal and placed on the cinder pit for fire cleaning, the flange oiler is filled quickly with a supply of clean oil under air pressure from a tank in a small building nearby where the temperature can be controlled in cold weather. The oil is piped directly to the cinder pit where a small flexible hose and bent pipe nozzle permit filling the flange oiler without the necessity of the man who attends to this work leaving the ground.

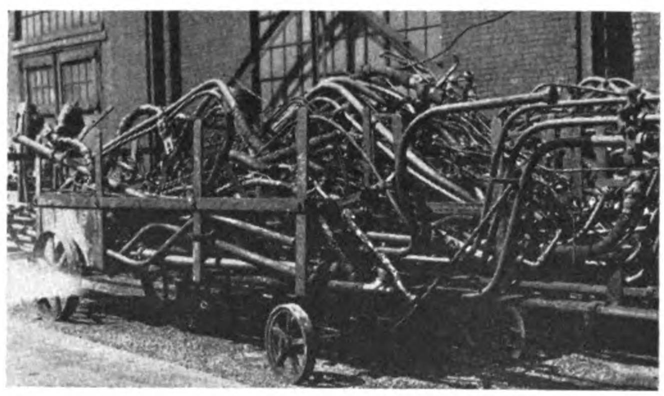


Mechanical lubricator filler used at the Centralia (Ill.) Enginehouse of the Illinois Central

More or less similar advantages are obtained by the use of the mechanical lubricator filler shown in the illustration. This device consists of a small tank mounted on two wheels and provided with a double-bar handle, electrically welded in place, for easy movement of the apparatus. The tank is provided with filling and drain plugs, also welded by the electric process, and a small hand pump which can be used to fill the mechanical lubricator without the necessity of the operator leaving the ground. Owing to the location of the mechanical lubricator usually in a restricted space under the running board, any attempt to fill it with the ordinary oil-can involves considerable climbing, physical effort and loss of time on the part of the oiler, to say nothing of expensive oil which may be wasted. The advantages of the equipment illustrated for the easy and efficient filling of mechanical lubricators will be readily apparent.

Portable Pipe Racks

THE handling of air and steam pipes removed from locomotives at the stripping tracks in shops presents a serious problem unless some systematic arrangement is in effect for segregating those removed from each individual engine and placing them in a designated place so that they will not get mixed with pipe removed from other engines of different classes.



The pipes from each locomotive are stored on a separate portable rack

To overcome this difficulty an arrangement was perfected by a stripping foreman at a locomotive back shop on an eastern railroad whereby all pipe, when removed from the engine, is placed in a portable container and stored in a designated location until required.

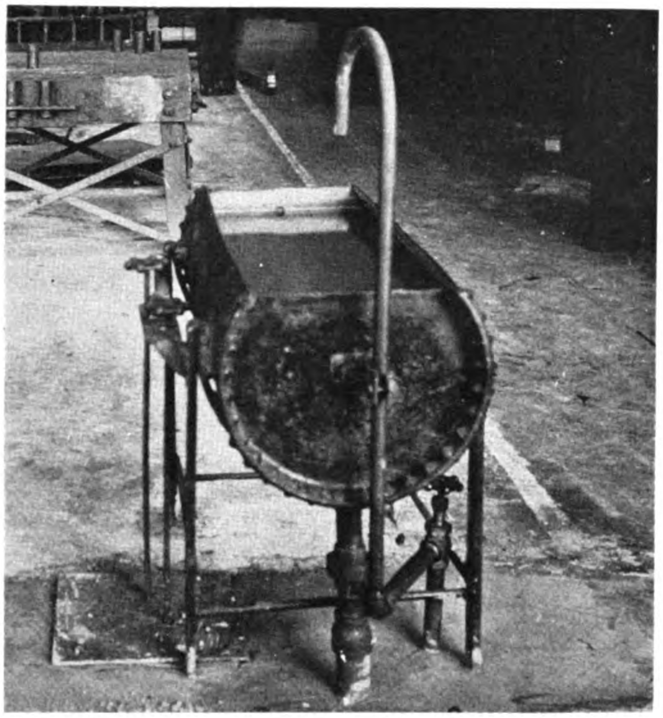
This container, as shown in the illustration, is mounted

on four cast-iron wheels and can either be pulled by a motor tractor or lifted by overhead crane to the storage platform or to the engine for application.

Cooling Trough For the Pipe Shop

A DISCARDED main reservoir removed from an engine due to failure during the hydrostatic test makes an ideal cooling trough for the pipe or blacksmith shop.

A cooling trough is as much a necessity in the pipe shop as it is in the blacksmith shop because pipe which



A cooling trough made from an old main reservoir

is heated and bent into various shapes or forms is ordinarily required for immediate use on the engine and should be cooled before it is handled by the workmen to prevent personal injury from burns.

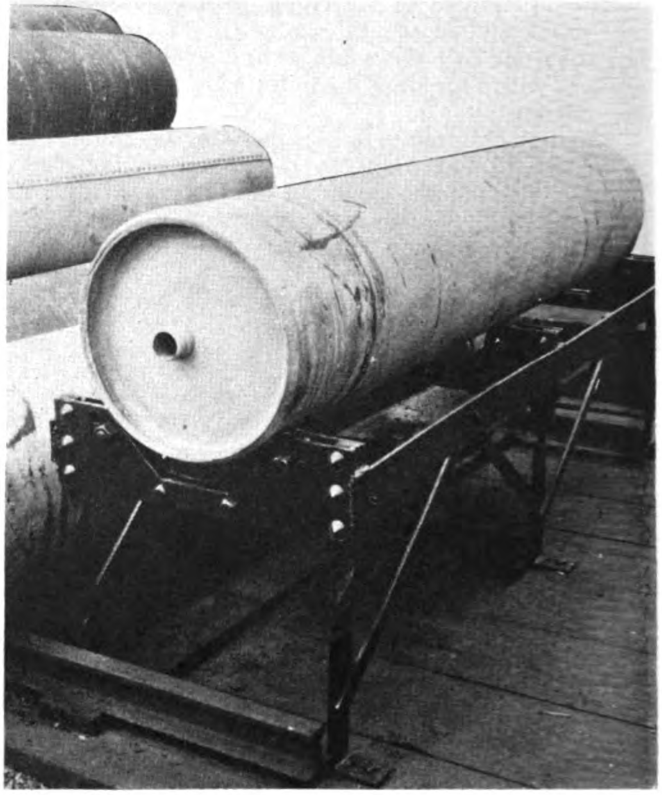
By cutting the reservoir, as shown in the illustration, sufficient depth is available to permit immersion of the average pipe bend used in the enginehouse or back shop. A water pipe and drain can be applied directly to the trough, effecting a continuous supply of cold water at all times.

Rack for Testing Main Reservoirs

MAIN reservoirs after being removed from engines going through the shop for classified repairs must be hammer tested and receive a hydrostatic test before they are reapplied.

This work can be greatly simplified by the installation of a rack similar to that shown in the illustration. It is so constructed that the workman may perform his duties without bending over and a drain at the center of the rack eliminates a water-soaked floor.

The rack is constructed of iron or steel and can be either riveted or welded together. It is 36 in. in length, 2 ft. wide and 2 ft. high to the top of the cradles. A roller on each side of each of the three cradles, so

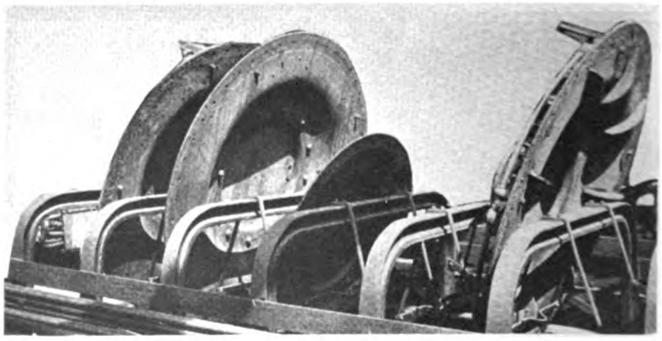


A rack of this type permits thorough inspection during hydrostatic testing

located that the reservoir rests on them when placed on the rack, permits the workman to turn the reservoir with little effort for the hammer test.

Front-End Storage Rack

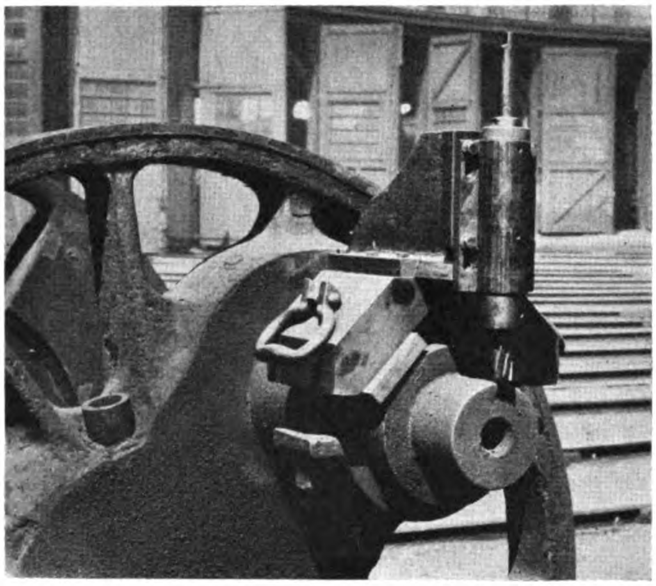
IN many locomotive shops it is not uncommon to find smokebox fronts leaning against the sides of buildings or thrown in piles at the first convenient location by the stripping gang. In other shops cars are provided on which the fronts are placed until needed, at which time the car is switched into the shop and the front replaced on the engine.



A storage rack for smokebox fronts made from 90-lb. rails

The rack for the storage of front ends as shown in the illustration was designed by the general foreman of a shop that formerly used the car handling system, which was found to be unsatisfactory because it was not always possible to have the car spotted under the overhead crane when the front end was needed. However the rack, which should be located in close proximity to the overhead cranes, not only presents a neat appearance, but also makes it easy to secure the front end when needed.

While ordinary 1½-in. by 6-in. bar iron can be used in manufacturing this rack, the one shown was made from discarded 90-lb. rails which were heated and formed 5 ft. from each end and welded to a bed plate. A ¼-in. by 4-in. strap of the desired length is welded on each side of the rails a distance of 4 ft. from the bottom which makes the rack sufficiently rigid to support the weight of the front ends. Cradles made from ½-in. by 2-in. wrought iron can be attached to the rails for supporting the fronts, and preventing contact with the bed plate but are not necessary if a soft-wood platform is provided to prevent damage to the edges.



Eccentric keyway miller which saves time at the Illinois Central enginehouse, Centralia, Ill.

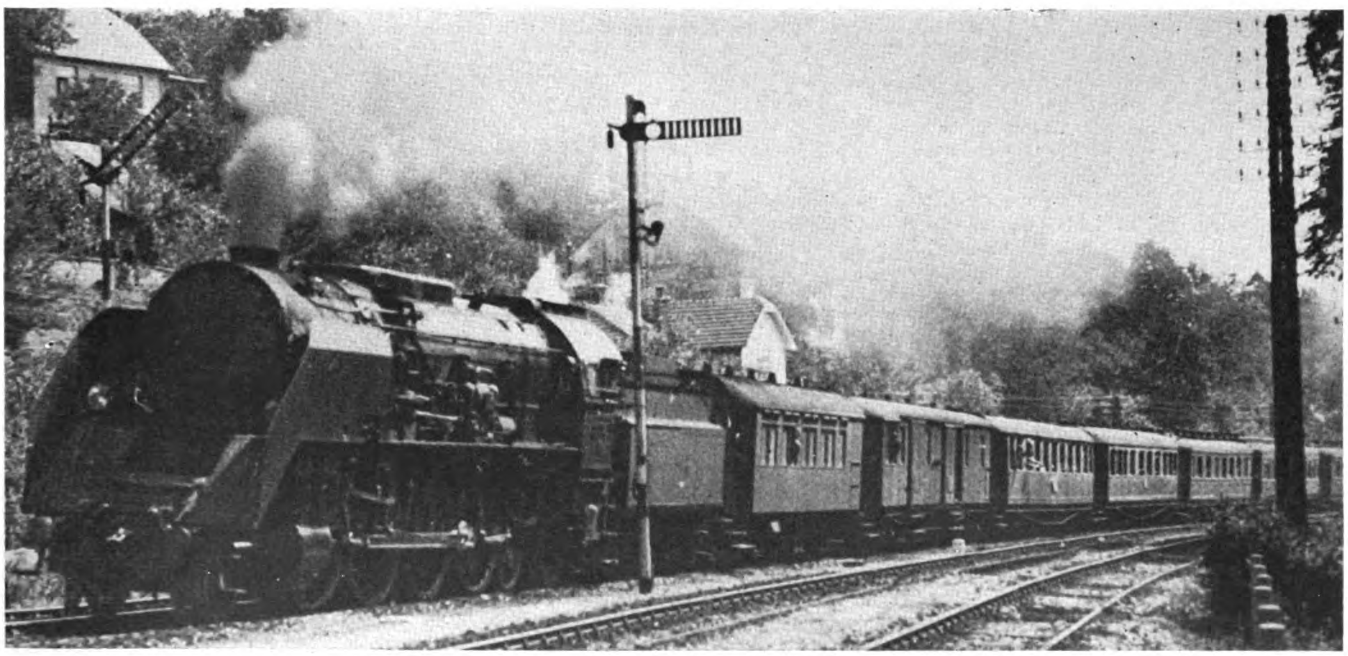
Keyway Miller

THE usual practice is to mill the eccentric keyways in crank pins before the pins are assembled in the wheel centers, and this permits doing the job on a shop machine of the proper size to assure accuracy and minimum time required for the operation.

Where assembled driving wheels, axles and crank pins are shipped from the main locomotive backshop to a smaller shop or engine terminal at some intermediate repair point, eccentric keyways must be made after application of the crank pins, or have recourse to the objectionable offset keys. Chipping and filing a keyway of any kind in steel by hand methods is generally undesirable, both from the point of view of accuracy and time required, and the eccentric keyway miller, shown in the illustrations, has, therefore been made at the Centralia (Ill.) enginehouse of the Illinois Central to conserve time and labor in cutting these keyways.

The eccentric keyway miller consists simply of a substantial V-block, resting on the journal and firmly clamped in place by means of a heavy strap and two bolts. The end mill, supported in a ball-bearing spindle and driven by an air motor, is capable of adjustment vertically to give the required depth of cut by means of slots in the tool head and four cap screws. Feed lengthwise of the journal is secured by means of a hand screw (not visible) which operates the right-angle bracket, carrying the tool head, in suitable V-ways. Convenient handles facilitate moving and adjusting the eccentric keyway miller on the crank pin.

* * *



Test train equipped with the Transit air brake—These tests were made under the supervision of the inventor and the air-brake manufacturers on several privately owned railroads in Sweden—A description of the Transit brake and a report of the tests were published in the May, 1930, *Railway Mechanical Engineer*

NEW DEVICES

York Air-Conditioning Equipment for Passenger Cars

Thirty-six of the 38 air-conditioned cars now operated by the Baltimore & Ohio employ a system of air-conditioning which receives its power from three different types of units mounted under the car, such as a gas-engine generator set direct-mechanical drive set, and body-hung axle generator set, thus allowing for free interchange of equipment. These cars are used to make up two complete trains operating between New York and Washington, D. C., and to provide air-conditioned parlor cars between these points on a train running between New York and St. Louis, Mo. The three trains are, respectively, the "Columbian", the "New York-Washington Express", and the "New York-Cincinnati-St. Louis Express". The Columbian was placed in service on May 24, 1931, and during the past summer the improved service has served greatly to increase the amount of passenger travel on these trains. The 36 cars have equipment furnished by the York Ice Machinery Corporation, York, Pa.

The York system of air-conditioning is designed in individual car units to provide flexibility of operation with respect to the handling of the cars in trains and in terminals. The cycle of refrigeration is closed and occurs outside the space occupied by passengers.

Referring to the drawing showing the location of the equipment on the car, air is drawn from the passenger compartments through an air-conditioning unit which is installed over the passageway to the vestibule. This unit may be installed as a vertical floor-type unit in a locker within the car. It is constructed of galvanized iron and contains, in addition to the pipe coils for circulating the brine, a surge drum and the complete fan assembly for circulating the air within the car. The fan is driven by a V-belt from a 32-volt motor of approximately 1 hp.

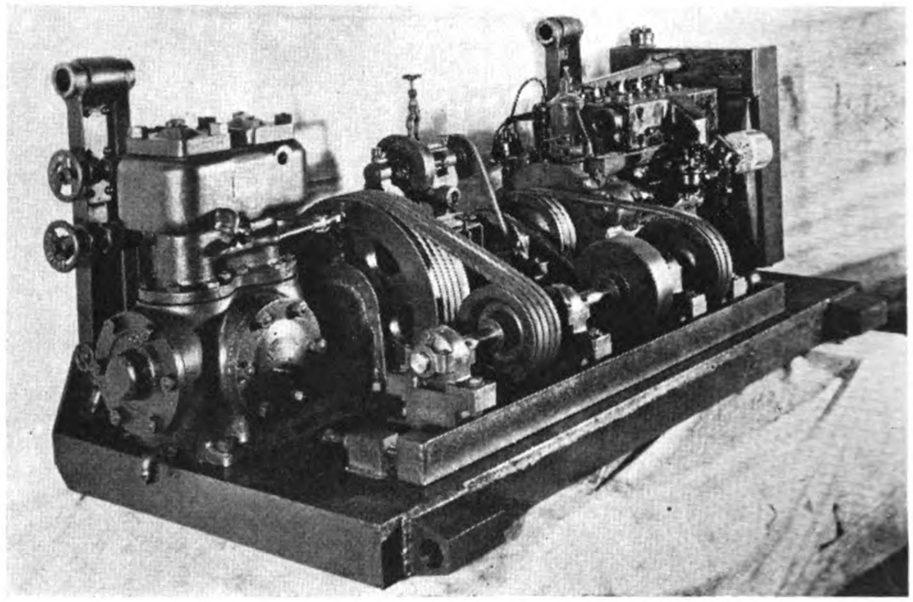
The brine which circulates through the air-conditioning unit is forced through a cooler by means of a pump. The location of the brine pump and cooler in the brine circuit through the air-conditioning unit is indicated in the drawing showing the cycle of operation for the system. The pump is of rotary design and is driven by a V-belt connected to the shaft of the gas engine on the direct mechanical-drive unit. The brine cooler is a closed, insulated shell, 6 ft. 5¾ in. long by 12¾ in. in outside diameter, and contains the coils through which the brine from the air-conditioning unit is circulated. It is supported underneath the car and is provided with an oil drain for removing any oil which may get into the refrigerating system.

A liquid refrigerant is fed to this cooler, the rate of flow of which is automatically regulated and controlled by a float regulator. As the refrigerant vaporizes under reduced pressure, it cools the secondary liquid (the brine in the air-conditioning-unit circuit) and is returned in the form of vapor to the compressor.

The compressor has a capacity of approximately four tons. On the direct mechanical-drive set, it is assembled together with a marine-type gasoline engine, water-circulating pump and brine-circulating pump, and mounted on a structural-steel base which is supported underneath the car by means of rubber-cushioned hangers secured to the underframe.

The refrigerant vapor is compressed and discharged into the condensing, or liquifying coils in the cooling tower, where it is cooled by a spray of water, converted to liquid and again circulated via a float regulator through the liquid cooler.

The water used for liquifying the refrigerant in the condensing coils is kept cool by the evaporative effect of the air forced through the cooling tower. Thus, the heat absorbed by the water spray from the refrigerant is discharged from the cooling tower to the outside atmosphere



Engine-compressor unit as it is assembled for mounting on the car

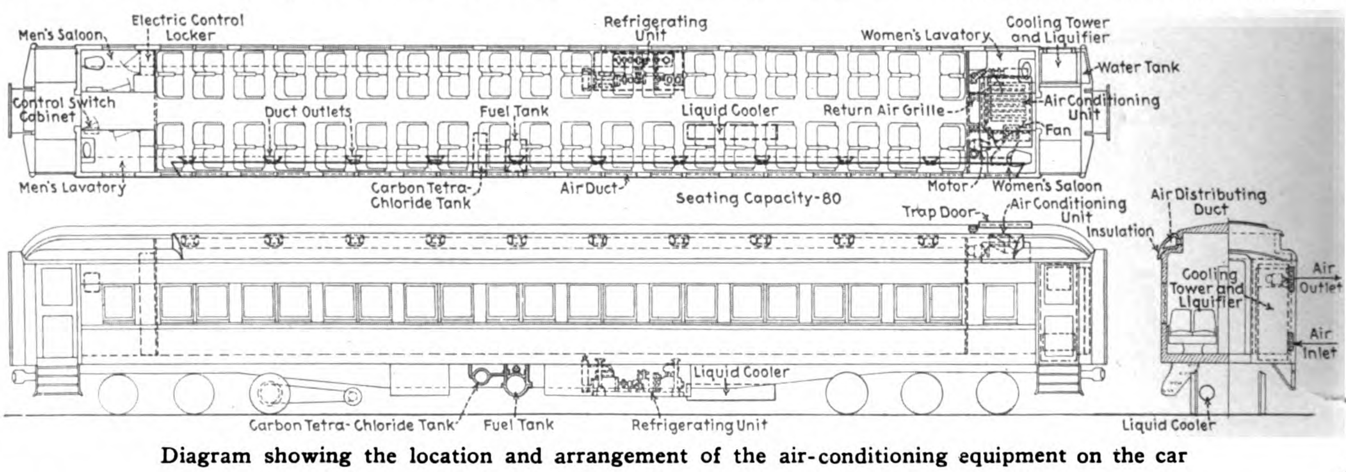
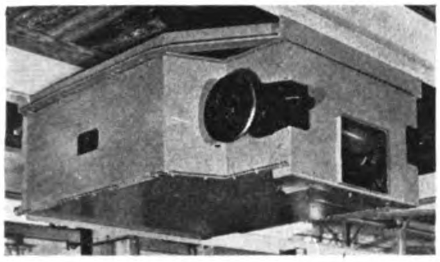


Diagram showing the location and arrangement of the air-conditioning equipment on the car

by the current of air which is sucked in at the bottom of the tower and discharged at the top by means of a fan driven by a 32-volt ½-hp. motor.

In the case of the Baltimore & Ohio installations, the cooling tower and tank for make-up water are located in one side of a vestibule. The water-spray chamber is of heavy galvanized sheet steel. The spray piping is provided with bronze nozzles designed to produce a series of sheets of mist across the path of the air

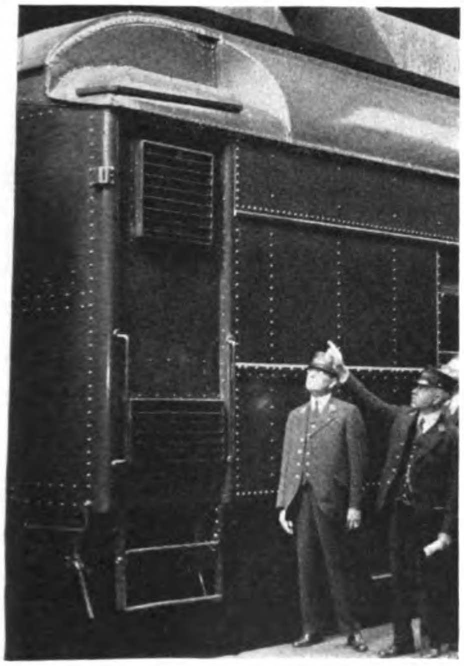


York air-cooling unit before installation at top of cars

and also to give the proper impingement against the refrigerant coils. Eliminators are provided at the top of the spray chamber to entrain the moisture from the air and return this water to the spray chamber and settling pan.

This pan is located in the bottom portion of the tower and is kept at a constant water level by means of an automatic float which regulates the supply of water from the make-up tank. Slosh plates, strainers, access doors and other auxiliary equipment are included in the equipment furnished with the cooling tower.

The liquid refrigerant is then pumped from the coils in the cooling tower through a float regulator to the brine cooler, as shown in the diagram of the cycle of operation. Thence it flows to



Appearance of the cooling tower from outside the car

the compressor, thus completing the cycle.

The gasoline engine on the direct mechanical-drive unit operates at slow speed and is connected to the compressor through a countershaft with over-running clutch by means of a V-type belt. This drive arrangement was adopted to avoid vibration and to permit the engine to start under no load. The countershaft is made adjustable to suit the drive. The brine and water-circulating pumps are also driven from the shaft of the engine to assure that these units are in operation at all times when the power plant is operating.

The engine is started by means of an electric-motor starter which is thermostatically controlled. It is also controlled by an automatic governor to maintain constant speed. Various safety and protective devices, such as high and low-pressure cut-outs, gages and other accessories, are provided to form a complete

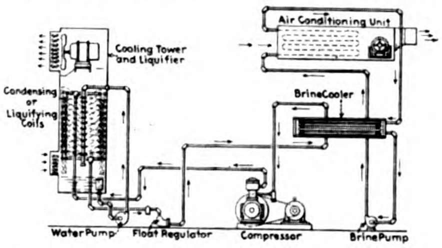
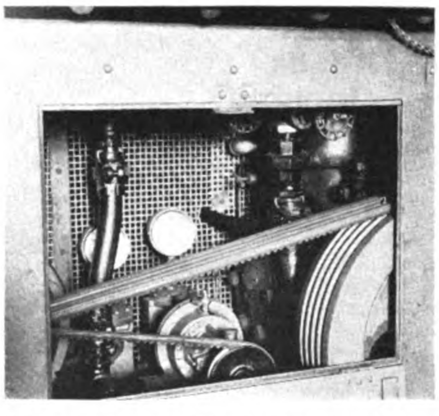


Diagram showing the cycle of operation

compressor-power unit, as shown in one of the illustrations. This unit, which is mounted on a platform suspended beneath the car, is enclosed in a ventilated steel casing. In case of fire, the gasoline supply tank is protected by means of a tank of carbon tetra-chloride which is connected to the fuel supply in such a manner as automatically to dilute the gasoline and make it uninflammable.

The electrical control panel, which is designed to be installed in a space approximately the size of a car-lighting panel, permits the operation of the air-conditioning equipment by push-button



Close-up view of York air-conditioning unit located beneath each car—It is readily accessible by opening the folding door of the steel compartment housing it

control. The location of a small push-button control cabinet containing the "stop", "start" and "run" push buttons is designed for easy access. A selector switch is also provided so that the air-conditioning fan may be operated without refrigeration for spring and fall use.

The air is distributed through the car by means of a duct which is located on one side of the car only, so that the ventilators on the opposite side may be opened in the usual manner in case the air-conditioning equipment is not in operation.

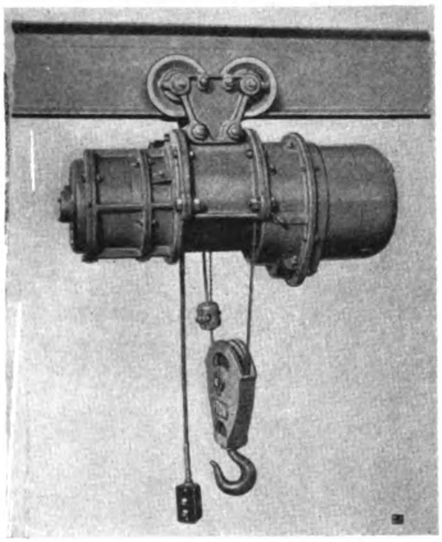
The air discharged from the air-conditioning unit is carried into the duct through special connections and deflectors. Thermostat control regulates the proper temperature of air to be discharged from each of the outlets in the car. The outlets, together with a system of deflectors, are arranged so there are no undesirable drafts.

The air discharges near the ceiling of the car at slow velocity and in such a manner as to mix with the air in the car by gradually descending at a uniform rate through the passenger space. The air is returned to the air-conditioning unit through the return-air grille.

The air-conditioning equipment weighs approximately 9,500 lb. The cooling equipment described above is subject to patents pending by the Baltimore & Ohio.

Wright Electric Trolley Hoists

The Wright Manufacturing Company, Bridgeport, Conn., has recently developed a new line of electric trolley hoists consisting of plain, geared and motor



The trolley-wheel bearings take up both radial and thrust loads

driven trolley types. The bearings of the trolley wheels are designed to absorb both radial and thrust loads, thus reducing the effort required to move the trolley along the I-beam to a minimum.

The trolleys come in plain, geared and motor-driven patterns. In the motor-driven trolleys, the wheels are driven on each side of the I-beam, insuring smooth operation, and are equipped with a safety stop. Controllers for a single speed, two speeds, or variable speeds

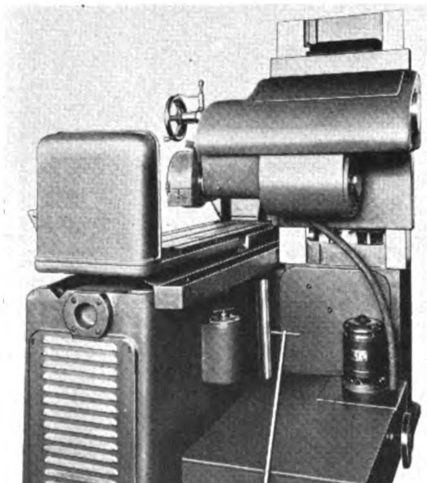
can be furnished. The hoists can be mounted either parallel or at right angles to the runway beam. While the standard lift is 18 ft., lifts of 9 and 36 ft. can be furnished. Features of the hoist include full size drums for long cable life, push-button or pendant-rope control, Tru-Lay preformed cable, safety type limit switch, positive braking and weather-proof motors.

Thompson Hydraulic Surface Grinder

The Thompson Grinder Company, Springfield, Ohio, has just placed on the market a surface grinding machine for rapid production on flat surfaces. The new grinder is fully hydraulic in operation.

Front view of the Thompson grinder showing the accessibility of controls

The table of the machine is reciprocated under the wheel in one direction only—the grinding head being traversed across the work. The table is actuated



Three-quarter rear view of the machine showing the portable coolant tank

by a hydraulic cylinder and may be reversed either by table dogs or manually at any point in its stroke. The wheel head is traversed hydraulically at both ends of the table reverse and is controlled by a valve which is instantly variable and reversible. A grinding wheel 10 in. in diameter by 3 in. wide is standard equipment and is mounted on a chrome-nickel spindle revolving in scraped, adjustable bronze bearings at both the front and the rear. The end thrust is taken by a hardened thrust collar on the spindle. A balanced rotor is keyed directly to the spindle tending to eliminate vibrations induced by indirect drives.

The cross feed to the head is hydraulic and automatic, acting at both ends of the stroke. Feeds may be obtained from 1/32 in. to 2 in. for each reverse, thus permitting rapid removal of stock at high speeds. The work head may be raised or lowered by means of a convenient hand wheel in the carriage. A micrometer index permits increments of .00025 in. to be obtained.

The oil pump for the table is located in the base and is driven by a 3-hp. motor belted with a vee-type drive. A generator with sufficient capacity for a full size magnetic chuck may also be mounted in the base and be driven from the 3-hp. motor. The entire mechanism is mounted on a heavy ribbed base, which is insulated from the base of the machine by vibration-absorbing material. The motors for the grinding head and table drive are controlled separately by push buttons and protected by overload relays.

All controls are located at the front of the machine. The table has an infinite speed range from 20 ft. to 100 ft. per min. The table is provided with ½-in. standard tee slots for mounting a magnetic chuck or work. Suitable splash guards are bolted to the table as the machine is primarily intended for wet grinding. The coolant tank is located outside of the machine at the rear and is mounted on wheels to facilitate cleaning or refilling. The interior of the base is ventilated by a fan mounted on the pump motor to insure an even temperature in the base.

Die Heads Self-Opening

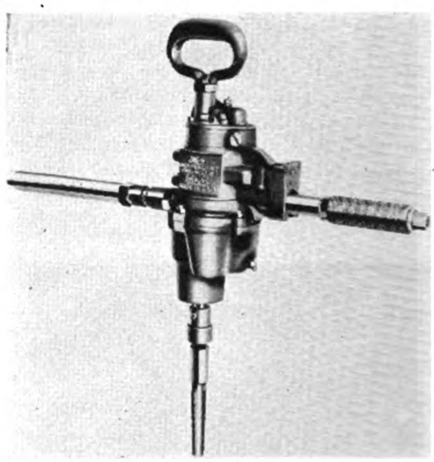
A self opening die head has been developed by the Eastern Machine Screw Corporation, New Haven, Conn., by means of which regrinding and sharpening are not necessary. Instead of using large chasers of high-speed steel, carriers have been substituted that take small high-speed inserts which are held in place by a single screw that has a draw-in feature which locks the insert back in the carrier so as to insure trackage and uniform distribution of the cut.

The carriers for any die head size are made to take inserts for a definite diameter range such as ¼ in. to ½ in., ½ in. to ¾ in. and the third size taking ¾ in. to 1 in. The same carriers are used for both the coarse- and fine-pitch series since the correct helix angle is in the chasers. This makes it unnecessary to have a different set of carriers for each different thread. The carriers themselves are larger than is usually the case and hence have nearly twice as much wearing surface where they slide in the carrier slots in the body of the die head. A set of chaser inserts for cutting threads of any given size can be used in any die head of this type.

Owing to the fact that regrinding is not a consideration in these die heads the insert type of chaser can be so made that its initial bearing clearances and cutting action are in correct balance for the extreme thread accuracies now required. When the insert chasers have been run to a point where threads no longer meet requirements a new set of chasers may be inserted in a few moments and no adjustment is required for the length of the thread. When changing chasers it is not necessary to screw a gage in the die head to adjust for size as almost no diameter adjustment is necessary even when shifting to a different thread size. The chasers may be removed at the machine without removing the carriers or the carriers and inserts may be removed entirely from the machine.

Air Tool for Tapping and Re-Tapping

The Independent Pneumatic Tool Company, 600 West Jackson boulevard, Chicago, has designed a rotary pneumatic drill especially for tapping and re-

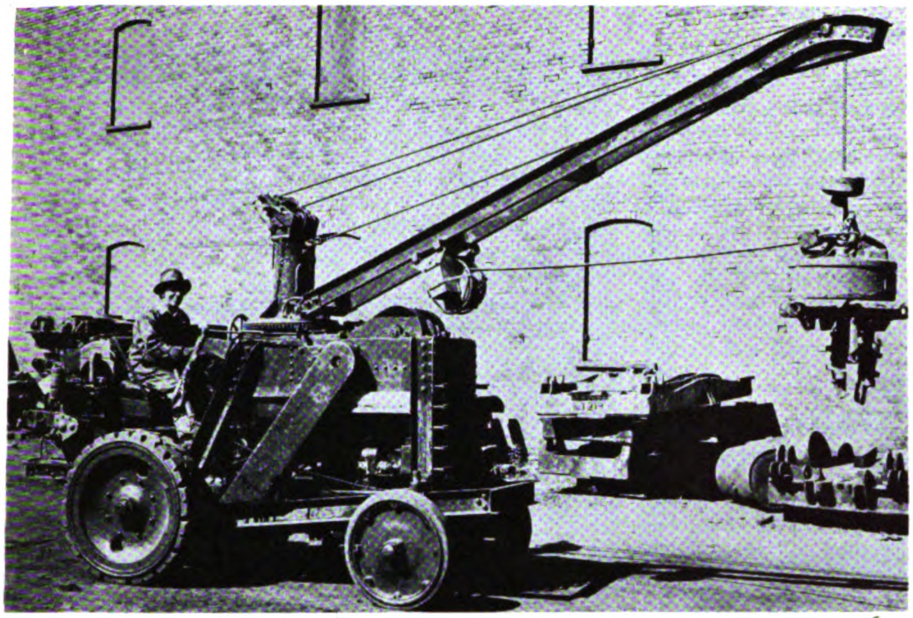


Thor No. 254R rotary air drill for tapping and nut setting

tapping stud holes, etc., on locomotive boilers.

This tool is constructed on the rotary air principle and is known as the Thor 254R. Tapping and re-tapping stud holes on boilers was formerly performed by hand labor and proved to be a slow, tiresome job. The Thor 254R is capable of tapping new holes up to and including 1 in. and re-tapping holes up to and including 1⅛ in. It can also be used for tapping new threads in cylinder-head castings on locomotives.

The light weight of this tool enables one man to handle it without any assistance. While designed for tapping, the 254R can also be used for putting on and taking off nuts, cap screws, etc.



The Loadmaster handling castings with a magnet

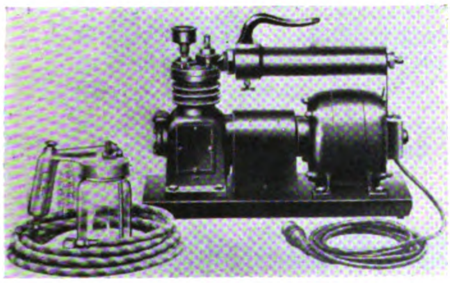
Loadmaster Equipped With Electro Magnet

The Loadmaster, manufactured by Bucyrus-Erie Company, South Milwaukee, Wis., and mounted on either wheels or crawlers, may now be obtained equipped with a 20-in. Ohio magnet. This magnet equipment facilitates handling scrap iron and small castings which ordinarily require considerable time for hooking. The Loadmaster has a fully revolving boom and can be used as a tractor, as a crane or can lift and travel with its load. Power is supplied to the magnet by a 2-kw. Kohler electric plant, mounted on the truck frame of the crane.

DeVilbiss Portable Spraying Outfit

An improved small portable spray-painting outfit, easily operated and carried by one person, has recently been developed by the DeVilbiss Company, Toledo, Ohio.

This low priced outfit, known as the DeVilbiss NC-607, is recommended for use by painters, decorators, contractors, builders and others as supplemental equipment for touch-up work on small sized painting or refinishing jobs. The NC-607 is a unit designed for small maintenance painting in hotels, buildings, and for refinishing furniture, store, office and home equipment. It is electrically driven and operates economically on any light socket. The compressor and motor are compactly and securely mounted on a rubber-footed metal base.



The DeVilbiss NC-607 outfit is easily handled by one man

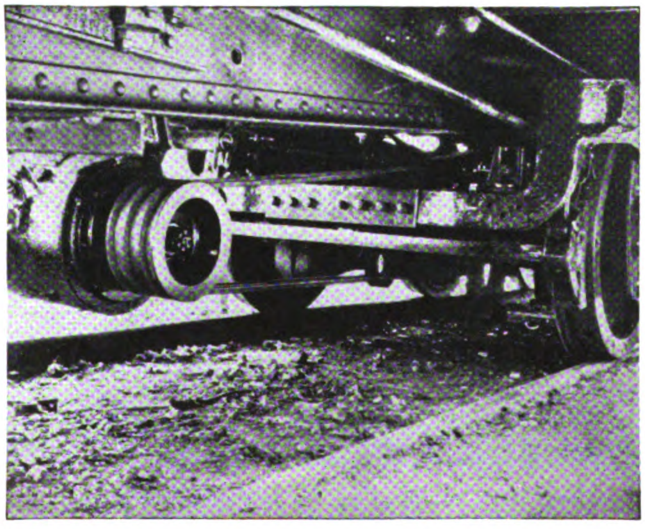
Texrope V-Belt Axle-Generator Drive

The Texrope V-belt drive, a product of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has been adapted to driving axle generators on railroad passenger cars, some of which have traveled well over 125,000 miles to date with entirely satisfactory results and no appreciable signs of belt wear. The drive consists of three endless V-type belts, transmitting power from a special triple V-groove pulley on the car axle to a similar pulley of smaller diameter keyed to the generator shaft. The pulley grooves are so proportioned and designed as to provide a firm, slightly wedging contact with the belts and eliminating slipping. The depth of the grooves, in conjunction with the angle to which the sides are machined, is said to prevent any possibility of the V-belts running out of the grooves under ordinary curve conditions and resultant truck angularity.

The principal advantage claimed for the Texrope V-belt drive, as applied to car axle generators, is a high degree of reliability under all weather conditions. As stated, the belts are positively held in the correct running position. There are no joints to fail or give trouble. Each belt is designed more than strong enough to carry the whole load if anything should happen to the other two belts, thus providing an unusually large factor of safety. In freezing weather, the wedging action of the belts pulling into the grooves has a tendency to eliminate the collection of dirt and the formation of ice, thus preventing difficulty from these causes.

Another important advantage claimed for this type of axle-generator drive is high efficiency. Power is transmitted by the wedging action of the belts as they pull into the V-shaped grooves of the sheaves. This construction assures smooth and positive starting, the belts absorbing vibration and the drive being said to operate with an efficiency of 98.9 per cent. The absence of belt slip keeps the generator at charging speed all of the time the car is at this speed and thus assures dependable power for lights and battery charging. In those cases in which the drive has been used the car batteries have received enough charge on the road to make charging at terminals unnecessary. In freezing weather the Texropes were found to be entirely free from ice or frost.

A feature of the drive, which would at first seem a serious objection, is the fact that the belts are endless and that the inside pair of truck wheels must be dropped in order to install the endless belts around the axle. It is also necessary to cut a small piece out of the truck frame and install a spacer block and a channel iron as a bracing member. Experience indicates that this operation requires only a little time, however, and, in view of the high reliability and long service life anticipated with this type of



The Texrope triple V-belt drive as applied to a body-hung car-lighting generator

belt, the V-belts will not ordinarily have to be replaced except when the car is in the shop for other repairs.

This type of V-belt drive is widely used (over 100,000 installations) in general industry and, when used in paper mills and other plants where power drives are constantly subjected to excessive moisture, dust and dirt, has given excellent results. The absence of belt slip under these adverse conditions prevents "burning up" of the belts and promotes long and effective service life, characteristics which railroads would like to see incorporated to an increasing extent in their axle-generator driving equipment.

Protective Paint For Pipe Lines

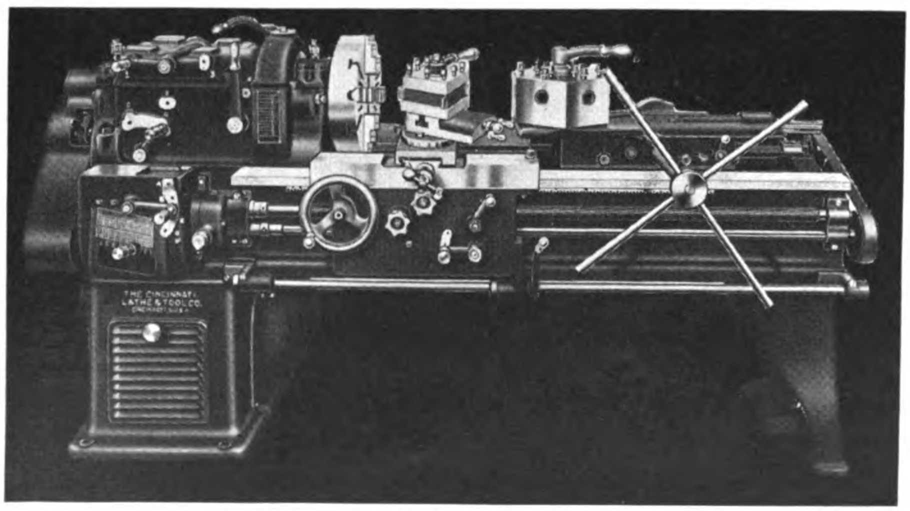
The American District Steam Company, North Tonawanda, N. Y., has developed a protective paint for use on steam and hot-water pipe lines. The product has been named Adsco Pipe-Kote 505. It is said to be impervious to any temperature generated by steam, to be practically immune to the action of moisture, dilute acids and alkalis, and that, while it produces an extremely hard, tenacious coating, it is sufficiently elastic to expand and contract with the pipe without cracking or peeling.

While Pipe-Kote is recommended for use on steam and hot-water lines, it works with equal effectiveness on gas and water mains, stacks, boiler fronts, bridges, and all other surfaces exposed to extreme or rapid changes of temperature and atmospheric conditions.

Turret Attachments For Cincinnati Lathes

The Cincinnati Lathe & Tool Company, Oakley, Cincinnati, Ohio, is now manufacturing hexagon bed turrets for the 16-in. to 32-in. lathes made by this company. The illustration shows one of the Cincinnati 20-in. by 10-ft lathes fitted with a hexagon bed turret, square tool block and four-jaw independent chuck. The hexagon bed turrets are automatically revolving and equipped with an automatic independent stop feed for each face of the turret.

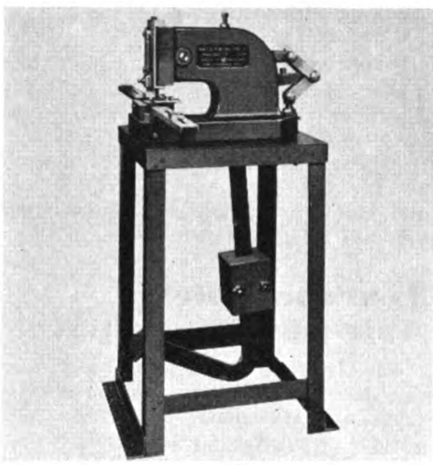
The feed may be either by hand or power. The power feed is actuated by a pulley drive from a rod at the back of the bed to the feed rod on the front of the machine. The power feed disengages automatically by a trip which stops within a reasonable degree of accuracy, but it is supplemented by a positive stop which enables the operator to finish lengths accurately to .001 in. A lever on the slide permits the indexing of the turret to any position without returning the slide to the extreme end of the stroke.



A 20-in. Cincinnati lathe equipped with a hexagon bed turret

Whitney Toggle-Lever Foot Press

The Whitney Metal Tool Company, Rockford, Ill., has recently placed on the market a type of toggle-lever foot press known as the No. 28 which has several new features of design. The capacity of this press is a 2-in. hole in a No. 16 gage sheet. The depth of the throat is 7 in., the height of throat, 4 in., and the stroke of the ram, one inch.

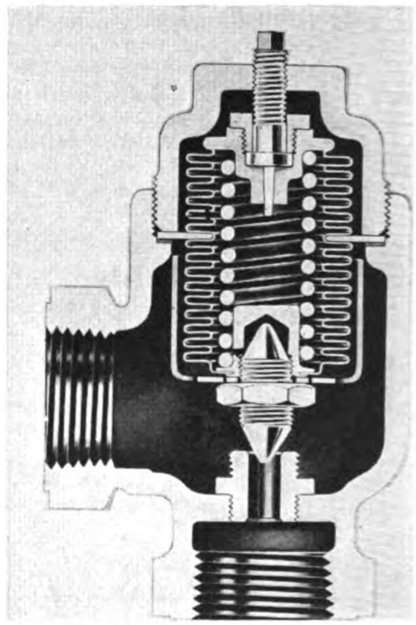


The Whitney press will punch 2-in. holes in No. 16 gage material

The machine has an adjustable regulation on the ram and positive-stop locking against the crank arm. The foot pedal is adjustable and there are six laminated hardened and ground tool-steel plates to take up the wear. The laminated discs can be arranged to adjust the stroke position of the ram one-half inch up or down. The machine is equipped with a bolster-plate die holder and the bolster plate is provided with a tee-slot. The speed of the machine is approximately 100 holes per minute.

Steam Trap with Thermostatic Control

The C. J. Tagliabue Manufacturing Company, Brooklyn, N. Y., is now manufacturing a steam trap with a differential setting feature which makes it possible to discharge condensate at a temperature corresponding to a uniform differential pressure from 0 to 20 lb. below the operating steam pressure. If the trap is set to discharge condensate at a temperature corresponding to as much as 20 lb. less than the operating steam pressure, it will discharge the condensate at this differential regardless of whether the steam pressure is 50 lb. or 125 lb. The trap is controlled by a differential setting screw which applies compression to a spring. When the compression is applied a mechanical pressure is created on the inside of a bronze bellows which aids the vapor pressure developed in the bellows to close the valve. Thus the mechanical pressure exerted by the spring determines whether the trap will close at or below the operating temperature of the steam.



Sectional view of the Tag differential setting steam trap

Among the mechanical features of the trap are the reversible and renewable Monel metal seats and discs, a bronze body and bronze bellows. The trap is manufactured in only one size 1 in.—as it is claimed the full 5/16 in. opening of the valve assures ample capacity.

Among the Clubs and Associations

Southern and Southwestern Railway Club.—W. M. Sheehan, manager eastern district sales of the General Steel Castings Corporation, will present a paper on Cast Steel Foundations for Railway Equipment at the meeting of the Southern & Southwestern Railway Club to be held at 10 a.m. on November 19 at the Ansley Hotel Roof Garden, Atlanta, Ga. Election of officers will also take place at this meeting.

New York Railroad Club.—The annual dinner of the New York Railroad Club is to be held this year on Thursday, December 17, at the Hotel Commodore, New York. Charles G. Melvin is general chairman of the dinner committee, and J. M. Davis, president of the Delaware, Lackawanna & Western, is chairman of the reception committee. H. H. Vreeland, chairman of the club's executive committee, will act as toastmaster at the dinner, while Dr. William Mather Lewis, president of Lafayette College, Easton, Pa., is to be the principal speaker.

International Conference on Bituminous Coal.—The Third International Conference on Bituminous Coal will be held under the auspices of the Carnegie Institute of Technology at Schenley Park, Pittsburgh, Pa., on November 16-21. The subject of railway fuel will be discussed Wednesday afternoon, November 18, the following papers having been arranged for this session:

Pulverized Fuel for Steam Locomotives, John C. Chapple, consulting engineer, St. Louis, Mo.
Trial and Road Results with Stug Pulverized Fuel Fired Locomotives, Richard O. Roosen, chief engineer, Henschel & Sohn, A. G. Kassel, Germany
Combustibility of Powdered Fuel in the Coal Dust Engine, T. Suwa, engineer, Imperial Japanese Fuel Research Institute, Tokyo
Railway Fuel, H. C. Woodbridge, manager, Rochester & Pittsburg Coal Company, Rochester, N. Y.
Associated with:
Malcolm Macfarlane, general fuel inspector, New York Central
C. P. Dampman, superintendent fuel conservation, Reading

D. F. Crawford, consulting engineer, Pittsburgh; F. M. Waring, engineer of tests, Pennsylvania, and P. A. Hollar, fuel agent, Pennsylvania, will discuss the papers.

American Society of Mechanical Engineers.—The annual meeting of the American Society of Mechanical Engineers will be held at the Engineering Societies building, New York, November 30 to December 4, inclusive. Honorary membership in the society will be conferred upon Dr. Palmer Chamberlain Ricketts on Tuesday evening, December 1, when Dr. Roy V. Wright, president, will also address the meeting. The Towne and Thurston Lectures will both be given at the meeting for the first time in several years. The Towne Lecture, which deals with the relationship between economics and engineering, will be delivered by Dean W. B. Donham of the Graduate School of Business Administration, Harvard University. The Thurston Lecture will be delivered by Dr. Edward L. Thorndike, professor of education at Teachers College, Columbia University, whose subject will be Psychology and Engineering. An interesting program resulting from the past year's study by the Committee on the Economic Status of the Engineer will be presented on Tuesday afternoon, December 1, and the series of talks on How To Talk with an Audience which was presented last year will be repeated at 8:50 a.m. on Tuesday, Wednesday and Thursday, December 1, 2 and 3, respectively, by Dr. S. Marion Tucker of the Polytechnic Institute of Brooklyn. The technical program in part is as follows:

MONDAY, NOVEMBER 30
Morning Session

Machine-Shop Practice and Applied Mechanics
Improved Device for Recording Instantaneous Tool Pressures in Machinability Studies, O. F. Gechter and H. R. Laird.
Photoelastic Developments.
a. Kinematography in Photoelasticity, Max M. Frocht.
b. Photoelastic Study of Shearing Stress in Keys and Keyways, A. G. Solakian and George B. Karelitz.
c. Celluloid as a Medium for Photoelastic Investigations, R. H. G. Edmonds and B. T. McMinn.

Afternoon Session
Metal Cutting

Elements of Milling, O. W. Boston and Charles E. Kraus.
Tungsten Carbide and Other Hard Cutting Materials, Progress Report No. 3 of Sub-Committee on Metal-Cutting Materials, Coleman Sellers, 3rd.
Motion Picture: Latest Development in German Machine Tools as Exhibited in Operation at Leipzig Trade Fair.

Evening

Exhibition of Art by Engineers.

TUESDAY, DECEMBER 1
Casting and Machine Design

Machine-Design Management, J. L. Alden.
Correlation of Design and Foundry, Alex Taub.
Progress Report of Machine-Shop Practice Division, C. deZafra.

Applied Mechanics and Railroads

Air Resistance of High-Speed Trains and Interurban Cars, O. G. Tietjens and K. C. Ripley.
Stresses in Railroad Track, S. Timoshenko and B. F. Langer.
Report of Railroad Division (by title).

Lubrication Research

Optimum Conditions in Journal Bearings, Albert Kingsbury.
Pressure Distribution in the Oil Films of Journal Bearings, S. A. and T. R. McKee.
Oil-Film Pressures in an End-Lubricated Sleeve Bearing, Louis J. Bradford.

Afternoon Session
General

Address by Francis Perkins on "State Labor Departments and Professional Engineers—Co-operation Essential to Progress in Accident Prevention."
Report of Committee on Economic Status of the Engineer.

Western Railway Club.—At the meeting of the Western Railway Club, scheduled to be held at the Hotel Sherman, Chicago, on November 16, the subject, "Patents and Railway Progress," will be presented by Charles L. Howard, assistant general counsel of the Western Railroad Association. Mr. Howard will describe the origin of patent laws and tell of early railway patents of unusual interest, devoting particular attention to such items as patentability, infringements, expired patents, the manufacture of repair parts for patented devices, patents granted to railway employees and the service afforded by the Western Railroad Association in connection with the railroads' use of patented articles.

Club Papers

Safety on the Railroads

Car Foremen's Association of Omaha.—Meeting held September 12 at Omaha, Neb. Subject, "Safety on the Railroads," presented by T. P. Schmidt, car foreman, Chicago, Milwaukee, St. Paul & Pacific, Council Bluffs, Iowa. ¶ After referring to the notable accomplishments of the railroads in accident prevention in all departments, including that devoted to the maintenance of car equipment, Mr. Schmidt called attention to a new type of potential hazard, aside from the loss of life or limbs, owing to the greatly increased amount of unauthorized riding on freight trains by hobos and other persons stealing rides in recent months. ¶ Regarding this subject, Mr. Schmidt said: "The railroad traveling public of the non-revenue type are good examples of the public's view of safety. For instance, I noted a train passing the other day which contained several tank cars loaded with gasoline and placarded all around for safety, with the running boards well occupied by passengers and a cloud of smoke emitting from pipes and cigarettes as if from a hot box. The weather was hot and the fumes of gasoline were in the air and, among the twelve or fifteen men aboard, no one gave a thought to the hazard involved. Railroad men are taught the dangers of such practices and shown their actual results, and we must guard our safety against non-observance by such people."

Air-Conditioned Passenger Cars

Western Railway Club. — Regular monthly meeting held at the Hotel Sherman, Chicago, Monday evening, October 19. Subject, "Steam Ejector System of Air Condition and Cooling Passenger Cars," presented by Richard Arf, mechanical engineer, Carrier Engineering Corporation, Newark, N. J. ¶ In the absence of President C. T. Ripley, chief mechani-

(Continued on next left-hand page)

cal engineer, Atchison, Topeka & Santa Fe, the meeting was presided over by Vice-President O. E. Ward, superintendent of motive power, Chicago, Burlington & Quincy, and some introductory remarks were made by F. A. Isaacson, engineer of car construction, Santa Fe. Preceding the delivery of Mr. Arf's prepared address, which was illustrated by lantern slides, Fred Wendell, superintendent of dining-car service, Harvey System, Chicago, made the following general comments regarding air conditioning, with particular reference to the performance of the air-conditioned dining car now in service on the Santa Fe train, "The Chief": "The great majority of passengers entering the air-conditioned dining car comment that it is a travel comfort much needed on trains in the summer time, especially since the adoption of all-steel cars, which are a great deal warmer than the old-time wooden cars. But, some of them are somewhat skeptical as to its general effect on their health, caused by the difference of temperature of the other equipment on the train, which is not air cooled. ¶ Therefore, it is really necessary that other cars, especially observation, lounge and club cars, should also be cooled and air conditioned. Moreover, the traveling public is looking forward to the time when all cars are air conditioned, and the supervisors of dining cars operating on various railways will, no doubt, be pleased when this day comes. ¶ Since deck ventilators are not needed on air-conditioned cars, neither are window screens used. This eliminates dust, soot and cinders, which in itself makes for comfort and sanitation. To make a car comfortable in the summer time by the use of electric fans is not possible, as this only stirs up the hot air in the car. People all enjoy dining in comfort, but so far we have not noticed any great increase in the food consumption. While the guests consume more hot foods in the summer time in an air-cooled diner, they eat less of cold foods, especially cold meats, ice cream, cold melons and iced drinks. ¶ As to increased travel on account of air-conditioned cars, it is hard to determine at this time, although a good many people made their reservations on days of departure of the Chief which has one air-conditioned car. But, in general, it was not noticeable that this train carried more people than the other trains on this same run. There is no doubt in my mind that whenever the cars on all trains on this run are air-conditioned, it will draw considerable travel to it. The air-conditioning system will be a great success if simplified and modified. Temperatures should range from 70 to 80 deg., but never below 70 deg. The mechanical devices and compressors should be made as simple and fool-proof as possible and take up a minimum of space, thereby reducing the expense of maintenance and making the equipment easy to operate. The installation on this one car takes lots of attention by the dining-car steward and anything applied for air conditioning and cooling cars should be such that it will not be necessary for the dining-car steward to be a mechanic to handle it."

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

Air-Brake Association.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

Allied Railway Supply Association.—F. W. Venton, Crane Company, Chicago.

American Railway Association.—Division V.—Mechanical.—V. R. Hawthorne, 59 East Van Buren street, Chicago.
Division V.—Equipment Painting Section.—V. R. Hawthorne, Chicago.
Division VI.—Purchases and Stores.—W. J. Farrell, 30 Vesey street, New York.
Division I.—Safety Section.—J. C. Caviston, 30 Vesey street, New York.
Division VIII.—Car Service Division.—C. A. Buch, Seventeenth and H. streets, Washington, D. C.

American Railway Tool Foremen's Association.—G. G. Macina, 11402 Calumet avenue, Chicago.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.
Railroad Division.—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York.
Machine Shop Practice Division.—Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.
Materials Handling Division.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.
Oil and Gas Power Division.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.
Fuels Division.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

American Society for Steel Treating.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

American Society for Testing Materials.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa.

American Welding Society.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

Association of Railway Electrical Engineers.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

Canadian Railway Club.—C. R. Crook, 2276 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month except in June, July and August, at Windsor Hotel, Montreal, Que.

Car Department Officers Association.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

Car Foremen's Association of Chicago.—G. K. Oliver, 2514 West Fifty-Fifth street, Chicago. Regular meeting, second Monday in each month except June, July and August, Great Northern Hotel, Chicago, Ill.

Car Foremen's Club of Los Angeles.—J. W. Krause, 608 South Main street, Los Angeles, Cal. Meetings second Monday of each month except July, August and September, in the Pacific Electric Club building, Los Angeles, Cal.

Car Foremen's Association of Omaha, Council Bluffs and South Omaha Interchange.—Geo. Kriegler, car foreman, Chicago, Burlington & Quincy, Sixteenth avenue and Sixth streets, Council Bluffs, Iowa. Regular meetings, second Thursday of each month at Council Bluffs.

Car Foremen's Association of St. Louis.—F. G. Weigman, 720 North Twenty-third street, East St. Louis, Ill. Regular meeting first Tuesday in each month, except July and August, at American Hotel Annex, St. Louis, Mo.

Central Railway Club of Buffalo.—T. J. O'Donnell, executive secretary, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meeting, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

Cincinnati Railway Club.—D. R. Boyd, 453 East Sixth street, Cincinnati. Regular meeting second Tuesday, February, May, September and November.

Cleveland Railway Club.—F. L. Frericks, 14416 Alder avenue, Cleveland, Ohio. Meeting second Monday each month, except June, July and August, at the Auditorium, Brotherhood of Railroad Trainmen's building, West Ninth and Superior avenue, Cleveland.

Eastern Car Foremen's Association.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings fourth Friday of each month, except June, July, August and September.

Indianapolis Car Inspection Association.—P. M. Pursian, 823 Big Four building, Indianapolis, Ind. Regular meetings first Monday of each month at Hotel Severin, Indianapolis, at 7 p.m. Noon-day luncheon 12:15 p.m. for Executive Committee and men interested in the car department.

International Railroad Master Blacksmith's Association.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

International Railway Fuel Association.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago.

International Railway General Foremen's Association.—William Hall, 1061 W. Wabash street, Winona, Minn.

Louisiana Car Department Association.—L. Brownlee, 3730 South Prieur street, New Orleans, La. Meetings third Thursday.

Master Boilermakers' Association.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

Master Car Builders' and Supervisors' Association.—See Car Department Officers Association.

National Safety Council—Steam Railroad Section.—W. A. Booth, Canadian National Montreal, Que. William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

New England Railroad Club.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting, second Tuesday in each month, excepting June, July, August and September. Copley-Plaza Hotel, Boston.

New York Railroad Club.—Douglas I. McKay, executive secretary, 26 Cortlandt street, New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York.

Pacific Railway Club.—W. S. Wollner, P. O. Box, 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

Pueblo Car Men's Association.—I. F. Wharton, chief clerk, Interchange Bureau, Pueblo, Colo.

Railway Business Association.—Frank W. Noxon, 1124 Woodward building, Washington, D. C.

Railway Car Men's Club of Peoria and Pekin.—C. L. Roberts, chief clerk, Peoria & Pekin Union Railway, 217 Lydia avenue, Peoria, Ill.

Railway Club of Greenville.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meetings third Tuesday of each month, except June, July and August.

Railway Club of Pittsburgh.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August, Ft. Pitt Hotel, Pittsburgh, Pa.

Railway Fire Protection Association.—R. R. Hackett. Baltimore & Ohio, Baltimore, Md.

Railway Supply Manufacturers' Association.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

St. Louis Railway Club.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

Southern and Southwestern Railway Club.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, July, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

Supply Men's Association.—E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division American Railway Association.

Toronto Railway Club.—J. A. Murphy, 1405 Canadian National Express building, Toronto 2, Ont. Meetings third Monday of each month, except June, July and August.

Traveling Engineers' Association.—W. O. Thompson, 1177 East Ninety-eight street, Cleveland, Ohio.

Western Railway Club.—J. H. Nash, 343 South Dearborn street, Chicago. Regular meetings, third Monday in each month.

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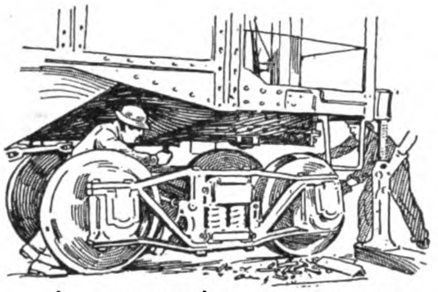
NEWS

THE CHICAGO, BURLINGTON & QUINCY has awarded a contract to G. A. Johnson & Son, Chicago, for the construction of a new coach shop, 212 ft. by 311 ft., at Aurora, Ill., to replace the structure recently destroyed by fire. The new building will be of brick, concrete and steel construction.

Safety Section, A. R. A.

THE FREIGHT CONDUCTOR who gives to new brakemen the benefit of his long experience, embodying his good advice in



As a car repairer, you were an unsafe man

friendly talks, was the hero of the Safety Section circular for November.

The brakeman in the story has a ten-year-old son who aims to be "a railroader like Dad"; and with this as his text the conductor preaches a sermon on how to set a good example when thus looked up to. The sermon is reinforced with admonitions based on pictures like those shown herewith and others.

Multi-Class Travel Coming Says Ogden

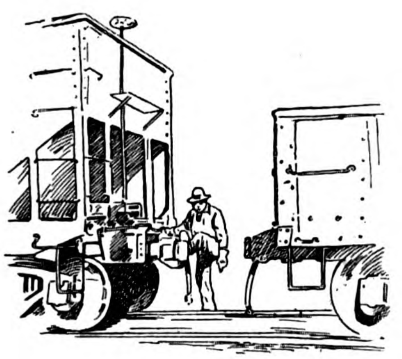
GEORGE D. OGDEN, New England vice-president of the Pennsylvania, addressing the Worcester (Mass.) Bond Club recently predicted that the railways would "ultimately realize that the European system of offering several distinct classes of passenger service has merits." This system, he said, "meets real needs, and is in no sense inconsistent with American institutions. We shall provide for the man who wishes to travel as cheaply as possible, and also for the one who can afford, and is willing to pay for, the super-luxuries.

"Store-door collection and delivery," he continued, "are destined to become universal. We, of the Pennsylvania, visualize the railways as the main arteries of travel and commerce, with their operations geared to heavy loads and high speeds, excelling in safety by a wide margin all other forms of transport, and serving directly only the large centers. Intermediate, local and feeder service, as well as short-distance service, is rapidly going to the highways.

"Electrification will be enormously extended, certainly to include all the densely populated areas, as well as service over heavy grades. The steam locomotive, however, is an extremely useful machine. Its complete disappearance, if that comes about at all, will be a matter of many years.

"The large railroad systems of the future will be completely integrated enterprises, serving the public by rail, highway, airway, waterway, lake and sea. Laws impeding them from so doing will be recognized as injurious, and repealed.

"Public opinion will undergo great changes with respect to the value of competition, particularly that which is arti-



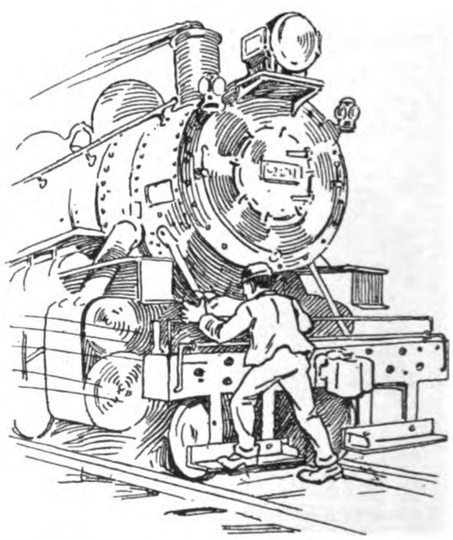
I saw you adjusting coupler with your foot as cars were coming together

ficially enforced by the so-called anti-trust laws. The rigors of the latter will surely yield to the march of progress—are visibly beginning to yield now. We shall have better, stronger and more useful railroads in the future than in the past, and the country's needs will give them more to do."

Roads Should Be Allowed to Accumulate Reserves

THE RAILROADS could be made an agency to contribute very largely to a stabilization of industry in general if they were allowed to accumulate in times of prosperity reserves which could be used in times of depression for normal maintenance expenditures, Daniel Willard, president of the Baltimore & Ohio, testified before a sub-committee of the Senate committee on manufacturers which is holding hearings on proposals for a national economic council. Mr. Willard said that when business is good it would seem wise to let the railroads earn a larger return than the law contemplates so that it would not be necessary to make such drastic reductions in expenditures when business is bad in order to maintain financial integrity. He pointed out, however, that the recapture law proposes to take away from a railroad half of any excess over 6 per cent earned in good times although, as the law has been administered, the railroads as a whole have never been allowed the fair return contemplated by the law. He expressed doubts as to how much could be accomplished by such a national planning body as has been proposed by some witnesses before the committee.

D. B. Robertson, president of the Brotherhood of Locomotive Firemen and Enginemen and chairman of the Railway Labor Executives' Association, testifying before the committee on the following day, advocated the plan for a national economic council. He said that 500,000 railway employees had been thrown out of employment as the result of the depression and 250,000 more through technological developments in the industry and that the outlook is discouraging. He said that many men are now working only



Boarding a switch engine in this manner is dangerous

part time in order to spread employment and criticized the railway managements for failure to co-operate with the labor organizations on their plan for "stabilizing" employment.

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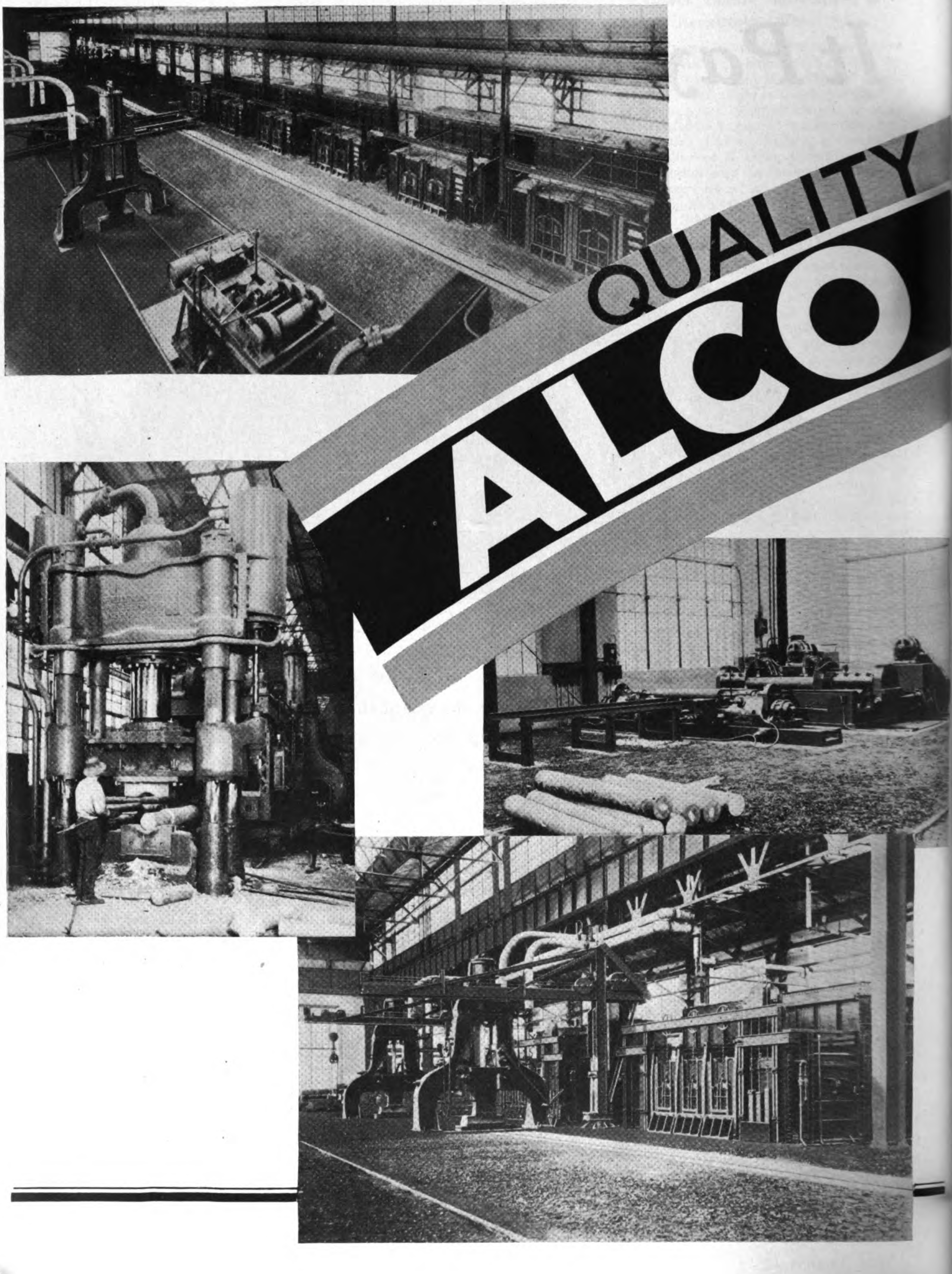
Freight Car Orders Reported During October 1931

Name of Company	Number Ordered	Type	Builder
Continental Oil Company	30	Tank	Pressed Steel Car Co.
U. S. Navy Department	8	Flat	Magor Car Corp.
Chicago & Illinois Midland	500	Gondola	Pullman Car & Mfg. Co.
	250	Hopper	Pullman Car & Mfg. Co.
Aluminum Ore Company	10	Hopper	Canton Car Co.
Total for month	798		

No passenger car or locomotive orders reported during month of October, 1931


QUALITY
ALCO

Supply Trade Notes

A. A. Probeck has been appointed sales manager of the Federal Machine & Welder Company, Warren, Ohio.

William B. Turner, division sales manager of the Truscon Steel Company at Youngstown, Ohio, has retired.

E. R. Dougherty has been appointed representative of the American Manganese Steel Company, Chicago Heights, Ill., for the Chicago district.

The Shepard Niles Crane & Hoist Corporation, Montour Falls, N. Y., has moved its office from the People's Gas building to 564 West Monroe street.

The Buckeye Portable Tool Company. Dayton, Ohio, has moved its factory and offices from 135 Wayne avenue to larger quarters at 29 West Apple street, Dayton.

F. J. Griffiths has joined the Timken organization at Canton, Ohio, and has been elected director and president of the Timken Steel & Tube Company. M. T. Lothrop, president of the Timken Roller Bearing Company, has been made chairman of the board of the Timken Steel & Tube Company. Mr. Griffiths has been identified with the steel industry for

F. J. Griffiths

30 years. Until recently he was associated with the Republic Steel Corporation as president of the Republic Research Corporation. Mr. Griffiths began his career in the steel industry with The United Steel Company at Canton, and later helped to organize The Central Steel Company, Massillon, Ohio, of which he was president and general manager. When these two companies were merged to form The Central Alloy Steel Company, he was chosen chairman of the board, which office he held until the Central Alloy was merged with the Republic Steel Corporation.

Lewis E. Porter, vice-president of S. F. Bowser & Co., Indianapolis, Ind., has been appointed vice-president and general manager of S. F. Bowser & Co., Ltd., Toronto, Ont. T. D. Kingsley, vice-president in charge of eastern sales, with headquarters at New York, has resigned.

H. W. Dillon has been appointed sales manager of the Gold Car Heating & Lighting Company, with headquarters at Brooklyn, N. Y.

The Verona Tool Works, with main office at Pittsburgh, Pa., has changed its name to the Oakmont Forgings Company, after selling its physical assets to the Woodings-Verona Tool Works.

Charles O. Guernsey, who has been appointed chief engineer of The J. G. Brill Company, Philadelphia, Pa., and its subsidiary companies, is now in charge of all Brill engineering activities. Mr. Guernsey has been connected with the Brill organization since 1923. For 10 years previous he was affiliated with the Service Motor Truck Company, Wabash, Ind., as chief

Charles O. Guernsey

engineer and later as vice-president in charge of the company's railroad division, the activities of which were transferred to the Brill Company in 1923, when Mr. Guernsey was appointed chief engineer, automotive car division. Under his direction the line of Brill rail motor cars for steam railroads was developed, and he has been interested in the design of electric railway rolling stock and other types of urban and interurban transportation equipment and of the electric trolley bus. Mr. Guernsey was appointed chief automotive engineer on January 1 last, remaining in that position until the recent unification of all Brill engineering activities under Mr. Guernsey's direction. He will be located at the Philadelphia plant.

George E. Totten, assistant manager of tin plate sales of the Jones & McLaughlin Steel Corporation, has resigned to become manager of sales of the tin plate division of the Republic Steel Corporation, Youngstown, Ohio.

Francis D. West, manager of sales of the Paradon Company has returned to the service of the Permutit Company, New York, as district sales manager, with headquarters at 712 Brisbane building, Buffalo, N. Y. Mr. West was associated with the Permutit Company from 1918 until 1930.

Charles H. Gayetty, who has been appointed manager of railroad sales of the Keasbey & Mattison Company, Ambler, Pa., was born at Oil City, Pa. He was educated in the high schools of his native city and also attended Temple University, Philadelphia, Pa. He began railway work in the operating department of the Pennsylvania at Oil City, and subse-

Charles H. Gayetty

quently served in the general freight department of the same road at its Broad Street Station, Philadelphia, remaining with the Pennsylvania for a total period of 11 years. Mr. Gayetty subsequently was in charge of sales of the railroad department of the Quaker City Rubber Company, Philadelphia. For the past five years he has been with the railroad department of the Boston Woven Hose & Rubber Company, Boston, Mass., and now becomes manager of railroad sales for the Keasbey & Mattison Company. Mr. Gayetty has been active at the conventions of the American Railway Association, held at Atlantic City, N. J., having served as chairman of the enrollment committee; and also, at a number of the conventions, as a member of the executive committee of the Railway Supply Manufacturers' Association.

The Pennsylvania Pump & Compressor Company, Easton, Pa., has formed a connection with Byer Engineering Associates, of the same city, with branch offices at 136 Liberty street, New York, and 1328 Chestnut street, Philadelphia, Pa.

The Ludlow Valve Manufacturing Company, Troy, N. Y., will manufacture its products for Canadian distribution under the name of The Canadian Ludlow Valve Manufacturing Company, Limited, 930 Wellington street, Montreal, Que., with factories at Three Rivers, Que., St. Thomas, Ont., and Fort William, Ont.

William T. Bentz has been appointed manager of sales of rail steel products, of the Republic Steel Corporation, Youngstown, Ohio. Mr. Bentz was formerly sales head of Steel & Tubes, Inc., a subsidiary of the Republic Steel Corporation. He will continue for the present to have his headquarters at Cleveland, Ohio.

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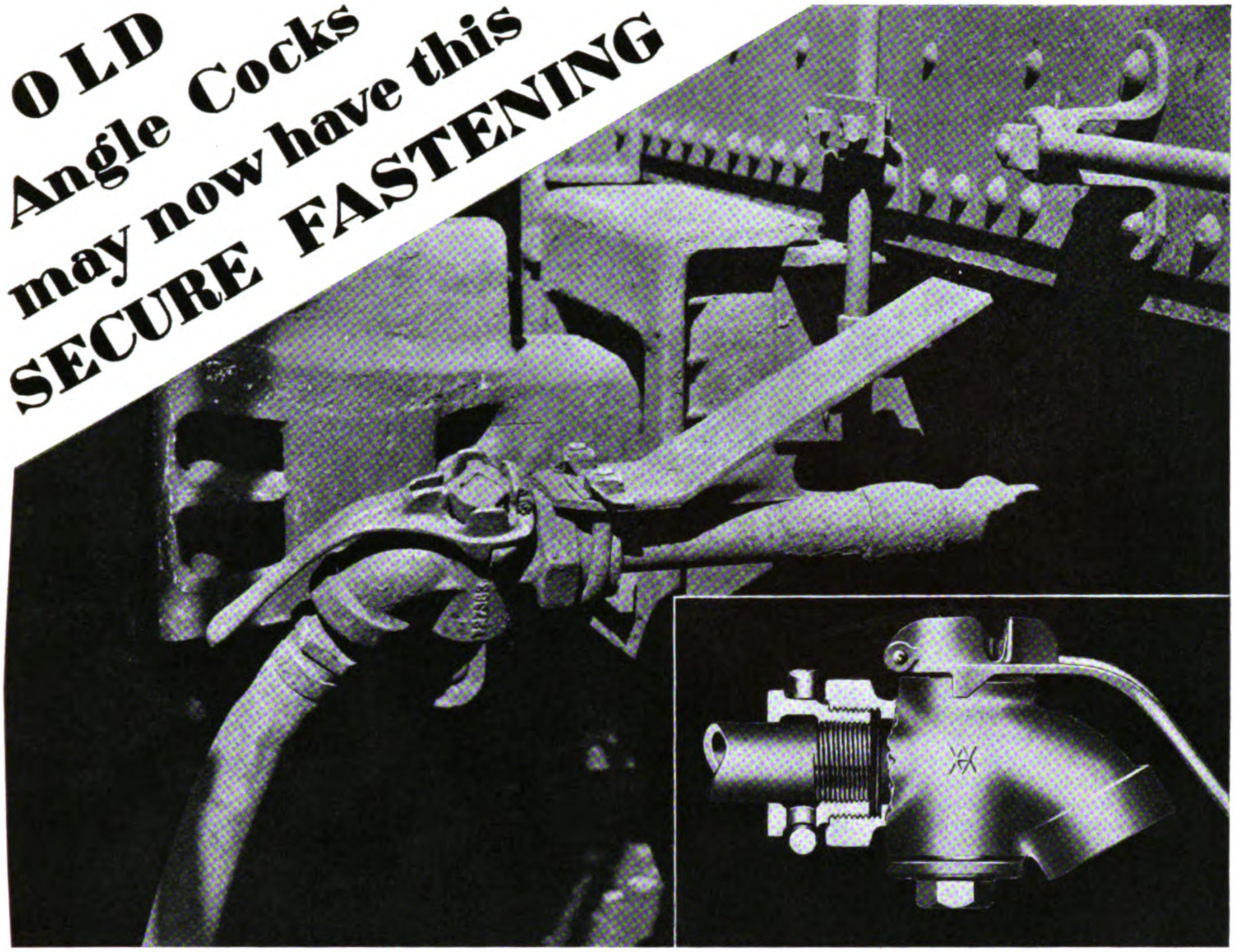


OUR improved angle cock having U bolt extension—now supplied with all new complete air brake equipments—permits such secure fastening as to prevent the cock turning or shifting its position, and support the pipe firmly back of the threaded joint.

Old angle cocks may have this feature added to them by inserting the bushing shown in the illustration . . . We suggest that all old standard angle cocks be converted by adding the bushing so as to obtain the recognized advantages of secure fastening—Complete information may be obtained by writing our nearest district office.

WESTINGHOUSE AIR BRAKE COMPANY

General Office and Works » » » WILMERDING, PA.

(1219)

Edward S. Sullivan, assistant coast agent of the St. Louis Car Company, has been promoted to coast agent, with headquarters at San Francisco, Cal., to succeed Gus Koch, deceased.

Robert S. Binkerd, formerly vice-chairman of the Eastern Railroads' Committee on Public Relations and latterly active in financial circles in New York, has been appointed director of sales of the Baldwin Locomotive Works.

Harry S. Sleicher, formerly vice-president of the North American Refractories Company, has severed his connection with that company and is now associated with the General Refractories Company in a sales capacity, with headquarters at New York.

Changes in the sales organization and additions to the staff of the Worthington Pump & Machinery Corporation, Harrison, N. J., as made effective recently, include the appointments of Otto Nonnenbruch, for the past four years chief engineer of the Diesel department of I. P. Morris and De La Vergne, Inc., Philadelphia, Pa.; as special sales representative with headquarters at Buffalo, N. Y.; of J. B. Allen, formerly president of the Allen Engineering Company, Bridgeport, Conn., and prior to that time with the Sperry Gyroscope Company, Brooklyn, N. Y., as special marine representative for Worthington, with headquarters at Harrison, and of H. G. Wood, formerly assistant manager of the New England division of the Westinghouse Electric & Manufacturing Company, as electrical sales engineer. E. M. Paullin, Jr., previously associated with the New York office of the General Electric Company as synchronous motor specialist, has been appointed electrical sales engineer at the Cincinnati, Ohio, works of the Worthington Corporation. John T. Clancy, assistant manager, Buffalo works sales division, has been transferred to Harrison, N. J.; E. W. Hammond has been transferred from Buffalo to Los Angeles, Cal., as special representative of Diesel and gas engine sales on the Pacific Coast, and A. M. Boehm has been appointed to a similar position at Kansas City, Mo., from the sales department of the Buffalo works. Joseph F. Hecking, formerly with the Diesel engine sales division in New York, has been assigned to the Diesel and gas engine sales division at Buffalo, and William J. Daly, assistant manager, Cincinnati works sales division, has been transferred to Pittsburgh, Pa., on special sales work. G. A. Herrmann and W. R. Kennedy, formerly sales engineers at Chicago and Pittsburgh, have been appointed acting district managers at St. Paul, Minn., and Kansas City, respectively.

Frank J. Baumis, formerly vice-president of Manning, Maxwell & Moore, Inc., and more recently with the Ingersoll-Rand Company, has organized the F. J. Baumis Company, with offices in New York and Boston, Mass. The new company will specialize in highway equipment for railroads and their affiliates, representing Warford Highway Transportation, manufacturers of motor truck chassis, and allied lines.

Gaylord Elected President of Machine Tool Builders

Robert M. Gaylord, president of the Ingersoll Milling Machine Company, has been elected president of the National Machine Tool Builders' Association. Clayton R. Burt, president and general manager of the Pratt & Whitney Company, has been elected first vice-president; Henry S. Beal, assistant general manager of the Jones & Lamson Machine Company, second vice-president, and G. E. Randles, president of the Foote-Burt Company, treasurer. S. Owen Livingston, first vice-president of the Gallmeyer & Livingston Company; E. A. Muller, president and treasurer of the King Machine Tool Company, and H. S. Robinson, secretary and sales manager of the Cincinnati Shaper Company, have been elected directors.

New Simmons-Boardman Officers

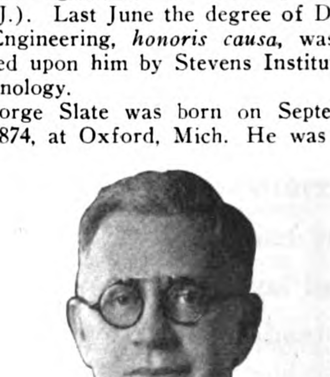
As a sequel to the election of Samuel O. Dunn and Henry Lee, formerly vice-presidents, to the chairmanship and presidency, respectively, of the Simmons-Boardman Publishing Company, publishers of *Railway Mechanical Engineer* and other railway and marine periodicals, other elections and appointments have been made as follows: Roy V. Wrignt, secretary of the company, has been elected vice-president anu secretary; George Slate, business manager of Marine Engineering and the Boiler Maker and a director of the company, has been elected also vice-president; Elmer T. Howson, western editor of Railway Age and editor of Railway Engineering and Maintenance, has been elected vice-president and a director; Frederick H. Thompson, vice-president in charge of the Cleveland office has been named to the directorate; and Frederick C. Koch, manager of advertising sales of the railway publications division of the company, has been elected vice-president. The headquarters of each will continue at heretofore; i.e., Messrs. Wright, Slate and Koch at New York, Mr. Thompson at Cleveland and Mr. Howson at Chicago.

Roy V. Wright was born at Red Wing, Minn., on October 8, 1876, and was educated at the University of Minnesota, from which he was graduated in 1898 with the degree of M.E. He entered railway service in the same year as a machinist apprentice on the Chicago, Milwaukee & St. Paul at South Minneapolis, Minn. Two years later he joined the staff of the Chicago Great Western as a draftsman and later became chief draftsman. In 1901 he was appointed mechanical engineer of the Pittsburgh & Lake Erie, which office he resigned in 1904 to become associate editor of the American Engineer and Railroad Journal (now the *Railway Mechanical Engineer*) In the following year he became editor of that publication and continued as such until 1910, when he became mechanical department editor of the Railway Age-Gazette (now Railway Age). In the following year he was appointed managing editor and has since continued in

Roy V. Wright

that capacity. Since 1912 he has also been editor of the *Railway Mechanical Engineer* and of the Car Builders Cyclopedia and the Locomotive Cyclopedia. He was elected a director of the Simmons-Boardman Publishing Company in 1915 and secretary in 1919. He is a member of the Transportation Committee and the Industrial Committee and chairman of the Board of Publications of the National Council of the Y. M. C. A. He served two terms as president of the United Engineering Society, New York, and is at the present time president of the American Society of Mechanical Engineers, in the work of which association he has long taken a prominent part. He is a member of the executive committee of the New York Railroad Club and of the advisory board of the department of smoke regulation of Hudson County (N. J.). Last June the degree of Doctor of Engineering, *honoris causa*, was bestowed upon him by Stevens Institute of Technology.

George Slate was born on September 27, 1874, at Oxford, Mich. He was edu-



George Slate

cated in the public schools of Alma and Grand Rapids, Mich., and started his business career in the classified advertising department of the Philadelphia Press,

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later moving to New York where he served the New York Journal in a similar capacity. His association with Marine Engineering dates back over 30 years, he having joined the staff of that publication as an advertising salesman on October 14, 1901. He was later elected a vice-president of the Aldrich Publishing Company, which at that time published that periodical. The company in 1905 acquired The Boiler Maker and Mr. Slate's jurisdiction was extended to include that journal as well as Marine Engineering. In 1920 the Aldrich Publishing Company with its two publications was acquired by the Simmons-Boardman Publishing Company and shortly thereafter Mr. Slate was elected a director of the latter company, on which board he has since served continuously. He is an associate member of the Society of Naval Architects and Marine Engineers. He was for 15 years secretary and treasurer of the Boiler Maker Supply Men's Association and has long interested himself in the affairs of that organization and the Master Boiler Makers Association. He has also been active in the work of the Associated Business Papers, Inc., and in the business paper division of the Audit Bureau of Circulations.

Elmer T. Howson was born at Folletts, Iowa, on May 23, 1884, and was educated at the University of Wisconsin, from which he received his B.S. degree in 1906 and his C.E. degree in 1914. He entered railway service in 1903 as field draftsman for the Iowa & Illinois Railway (now the

Elmer T. Howson

Clinton, Davenport & Muscatine). He later became an instrumentman for the same road and in 1905 went with the Chicago, Burlington & Quincy in the same capacity. From 1906 to 1909 he was a resident engineer and assistant engineer on heavy construction of the same road and from 1909 to 1911 was division engineer. In the latter year he entered the service of the Railway Age-Gazette as engineering editor and in 1919 was appointed Western editor of the Railway Age, in which capacity he has since served continuously. Since 1916 he has also been editor of Railway Engineering and Maintenance and of the Railway Engineering and Maintenance Cyclopedia. He is a past president of the American Railway Bridge and Building Association, the Western Society of Engineers, the Track Supply Association and the National Conference of Business Paper Editors. At the present time he is president of the Roadmasters' and Maintenance of Way Association, first vice-president of the American Wood-Preservers' Association, a member of the executive council of the American Association of Railroad Superintendents, and a member of the executive committee of Associated Business, Papers, Inc. He is a member of the Society of Civil Engineers, which he has served as chairman of its Illinois section.

Frederick H. Thompson was born in Cleveland, Ohio, on August 1, 1885. He attended the Brooks School at Cleveland and the University School and Military

Frederick Hurd Thompson

Institute at East Orange, N. J. He started his business career as a newspaper reporter in New York in 1902 and served for a time as dramatic critic. From 1904 to 1907 he was eastern representative of the Music Trade Review. He was business manager of the *Railway Mechanical Engineer* from 1912 to 1920 and was general manager for the Simmons-Boardman Publishing Company in the Central district at Cleveland, Ohio, from 1920 to 1924. Since the latter date he has been a vice-president of the company in charge of the Central district, with offices at Cleveland.

Frederick C. Koch was born in Jersey City, N. J., on June 9, 1893, and was

Frederick C. Koch

educated in the public schools of New York. He entered the employ of the Railway Age-Gazette in 1909 in a minor capacity and rose through various clerical positions to the managership of the advertising make-up department. In 1917 he became advertising sales representative for all Simmons-Boardman transportation publications with the title of assistant to vice-president. In 1925 he was appointed business manager of Railway Engineering and Maintenance and continued in that capacity until a few months ago when he was appointed manager of advertising sales of the railway publication division of the Simmons-Boardman Publishing Company.

Obituary

William K. Bixby, who retired as president of the American Car & Foundry Company in 1905, died in St. Louis, Mo., on October 29, from myocarditis.

Robert H. Ripley, senior vice-president of the American Steel Foundries and chairman of the board of the General Steel Castings Corporation, died in Chicago on November 4. Mr. Ripley had been identified with the steel castings and steel railway equipment industries during his entire business career of more than thirty years, with the exception of about

R. H. Ripley

one year when he practiced law in Chicago following his graduation from Cornell University in 1899 with an L.L.B. degree. He was a son of Edward P. Ripley, former president of the Atchison, Topeka & Santa Fe, and was born at Boston, Mass., on June 6, 1876. Prior to entering Cornell he attended Shattuck Scientific School at Fairibault, Minn. During 1901 and 1902 he served as a salesman for the Railway Steel Spring Company, being later connected with the Simplex Railway Appliance Company until 1905 when that company became a part of the American Steel Foundries. He was appointed a vice-president of the American Steel Foundries in 1905 and for the past two years had been senior vice-president. Early in 1929 he was elected also president of the General Steel Castings Corporation, which position he held until June 6, 1931, when he became chairman of the board.

C. B. Woodworth, manager of the railroad division of the Vanadium Corporation of America, with headquarters at Chicago, died at his home on October 24. Mr. Woodworth was graduated in mechanical engineering from Purdue University in 1907 and from then until 1916 he served with the mechanical departments of the Wabash and the Baltimore & Ohio

C. B. Woodworth

in various capacities from machinist to general foreman of the Mt. Clare shops of the B. & O. He then entered the employ of the American Arch Company, serving until 1918, when he received a commission as captain of engineers in the United States Army. After a service of 15 months with the A. E. F. on railroad work in France, he returned to this country and joined the foreign sales department of the American Locomotive Company, spending six years in the Argentine and in Brazil engaged in sales and service work. In 1926 he went with the Premier Staybolt Company as special technical representative; in May of the following year he left that service to become manager of the western division of the Vanadium Corporation of America, at Chicago, and in August, 1930, was appointed manager of the railroad division.

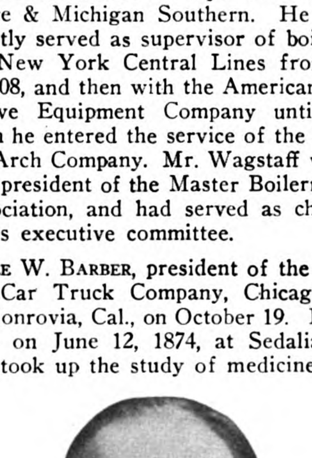
Nathaniel Curry, chairman of the board of the Canadian Car & Foundry Company, and a member of the Canadian Senate, died at his summer home at Tidnish, N. S., on October 23. Mr. Curry was born on March 26, 1851, in Kings county, Nova Scotia. In association with Nathaniel Rhodes, he founded Rhodes-Curry, Ltd., and was instrumental in consolidating that company with several other Canadian plants to form the Canadian Car & Foundry Company. He first served as president of the latter company, but several years ago retired from that office to become chairman of the board. Mr. Curry had spent some years in the United States in connection with railway and mining companies; he had been at various times connected with a number of industrial concerns as president or director, and had served as a member of the Canadian Senate since 1912.

George Wagstaff, formerly traveling engineer of the American Arch Company New York, who retired from active service about three years ago, died on October 11 at his home in West New York, N. J. He was born on March 29, 1858, at Shropshire, England. Mr. Wagstaff, who joined the American Arch Company in 1910, was well known in the railway field having previously served since 1879 in various positions in the United States with the Lehigh Valley, the Rome Locomotive Works, the Delaware, Lackawanna & Western, the Grant Locomotive Works the Chicago & North Western, and the New York Central, until 1903, when he was appointed assistant master mechanic

George Wagstaff

of the Collinwood shops of the Lake Shore & Michigan Southern. He subsequently served as supervisor of boilers on the New York Central Lines from 1905 to 1908, and then with the American Locomotive Equipment Company until 1910, when he entered the service of the American Arch Company. Mr. Wagstaff was the first president of the Master Boilermakers' Association, and had served as chairman of its executive committee.

Lee W. Barber, president of the Standard Car Truck Company, Chicago, died at Monrovia, Cal., on October 19. He was born on June 12, 1874, at Sedalia, Mo., and took up the study of medicine at the



Lee W. Barber

University of Minnesota. After being forced to relinquish his studies because of ill health, Mr. Barber entered the service of the Standard Car Truck Company as an inspector of equipment. He was promoted successively through various positions including that of secretary and assistant treasurer, being elected president in 1920.

Personal Mention

General

J. P. Chadwick, mechanical engineer of the Southern, at Washington, D. C., has been appointed to assistant to vice-president, mechanical, succeeding R. L. Ettenger, transferred at his own request, to the position of mechanical engineer.

W. R. Lye, district superintendent of motive power on the New York Central, with headquarters at Collinwood, Ohio, has assumed also the duties of the superintendent of shops at the same point, succeeding W. J. Shasberger. The position of superintendent of shops has been abolished.

J. A. Sheedy, superintendent of motive power of the Northwestern division of the Pennsylvania at Chicago, has been transferred to the Southwestern division, with headquarters at Indianapolis, Ind., succeeding G. W. West, acting superintendent of motive power, who has been appointed superintendent of the Monongahela division.

Martin F. Brown, general fuel supervisor of the Northern Pacific, with headquarters at St. Paul, Minn., has been granted an indefinite leave of absence on account of ill health. The duties of general fuel supervisor have been assumed by Clarence E. Allen, assistant to mechanical superintendent, at St. Paul.

Master Mechanics and Road Foremen

Otto J. Protz has been appointed assistant master mechanic of the Iowa, Northern Iowa and Sioux City divisions of the Chicago & North Western, with headquarters at Clinton, Iowa.

W. S. Whitford, master mechanic of the Iowa division of the Chicago & North Western at Clinton, Iowa, has been appointed master mechanic of the Iowa, Northern Iowa and Sioux City divisions, with headquarters at Boone, Iowa.

J. B. Moore, master mechanic of the Northern Iowa division of the Chicago & North Western at Belle Plaine, Iowa, has been transferred to the Peninsula division, with headquarters at Escanaba, Mich., to succeed O. J. Protz.

M. J. Hayes, general foreman, locomotive department, of the Toronto, Hamilton & Buffalo, has been appointed master mechanic. The position of superintendent motive power rendered vacant by the death of W. T. Kuhn has been abolished.

Car Department

E. F. Palmer, general car foreman of the Chicago, Milwaukee, St. Paul & Pacific at Sioux City, Iowa, has been transferred to the position of general car foreman at Green Bay, Wis.

(Continued on next left-hand page)

F. A. SHOULTY has been appointed general car foreman of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Sioux City.

M. L. HYNES, general car foreman of the Chicago, Milwaukee, St. Paul & Pacific, at Green Bay, Wis., has been transferred to the position of general car foreman at Milwaukee, Wis.

W. E. CAMPBELL, general car foreman of the Chicago, Milwaukee, St. Paul & Pacific, at Milwaukee, Wis., has been promoted to the newly-created position of district master car builder on the Western Lines, with headquarters at Tacoma, Wash.

Shop and Enginehouse

J. S. FLOW, general foreman of the Southern at Selma, N. C. ,has been transferred to the position of general foreman at Greensboro, N. C.

D. A. MARCHE, assistant night engine house foreman of the Southern at Spencer, N. C., has been appointed assistant day enginehouse foreman.

D. M. KEEVER, assistant day enginehouse foreman of the Southern at Greensboro, N. C., has been promoted to the position of general foreman, with headquarters at Selma, N. C.

O. R. DIAMOND, foreman, locomotive department, of the Kansas City Southern at Shreveport, La., has been transferred to the position of general foreman at Kansas City, Mo.

THE POSITION of assistant shop superintendent of the Atchison, Topeka & Santa Fe at Topeka, Kan., which was occupied by W. L. Jury, has been abolished, and the duties of this office have been assigned to J. H. Armstrong, general foreman locomotive shops.

G. B. HART, assistant to the general superintendent of motive power of the Southern Pacific, Pacific lines, with headquarters at San Francisco, Cal., has been appointed superintendent of the Los Angeles (Cal.) general shops, succeeding H. H. Carrick, who has retired. The position of assistant to the general superintendent of motive power has been discontinued.

Purchasing and Stores

JOHN OTTO has been appointed general storekeeper of the Elgin, Joliet & Eastern, with headquarters at Joliet, Ill.

W. R. CULVER has been appointed general storekeeper of the Chesapeake & Ohio, with headquarters at Huntington, W. Va. The position of general supervisor of stores has been abolished.

E. A. CARLSON has been appointed general storekeeper of the Pere Marquette, with headquarters at Grand Rapids, Mich. The positions of general supervisor of stores and of assistant general storekeeper have been abolished.

W. G. BLACK has been appointed assistant vice-president of the Chesapeake & Ohio and the Pere Marquette, with headquarters at Cleveland, Ohio. Mr. Black will have charge of purchases and stores, in addition to the duties he has heretofore performed.

THE JURISDICTION of G. D. Tombs, division storekeeper on the Illinois Central, with headquarters at Memphis, Tenn., has been extended to include the Vicksburg Route and New Orleans divisions. The position of division storekeeper of the latter divisions which has been held by C. S. Roberts, with headquarters at Vicksburg, Miss., has been abolished and Mr. Roberts has been assigned to other duties. The jurisdiction of the Burncide general store, Chicago, has been extended to include the Illinois and Springfield divisions; the position of division storekeeper of these divisions, which has been held by R. J. Gable, with headquarters at Clinton, Ill., has been abolished, and Mr. Gable has also been assigned to other duties.

Obituary

GEORGE H. LANGTON, general master mechanic of the Chesapeake & Ohio, eastern general division, with headquarters at Clifton Forge, Va., died on September 12. Mr. Langton was born on April 13, 1872, at Hannibal, Mo. After serving an apprenticeship as a machinist on the Chicago, Burlington & Quincy, he worked as machinist, enginehouse foreman, general foreman and engineer on various roads, and later served as master mechanic on the Sierra Railway of California, the Kansas City Southern, and the Texas & Pacific. He was at one time superintendent of shops and master mechanic on the Seaboard Air Line, and also held the same positions on the Virginian. Mr. Langton came to the Chesapeake & Ohio early in 1923, as mechanical inspector, and was appointed general master mechanic on February 1, 1924.

WILLIAM T. KUHN, superintendent motive power of the Toronto, Hamilton & Buffalo, died suddenly from a heart attack at his home in Hamilton, Ont., on September 26. He was born at East Radford, Va., in 1872, and, after attending public schools, he completed his education with a mechanical course at a correspondence school in Scranton, Pa. Mr. Kuhn entered railway service with the Norfolk & Western, in 1888, as a machinist apprentice, and served consecutively to 1900, as machinist, enginehouse foreman, and assistant air-brake instructor. In 1900 he entered the service of the Lake Shore & Michigan Southern (now part of the N.Y.C.) as enginehouse foreman and mechanical inspector, and continued with that road until March, 1911 when he undertook the position of assistant master mechanic of the Lake Erie & Western (now part of the New York, Chicago & St. Louis). He became connected with the Toronto, Hamilton & Buffalo on October 16, 1911, as master mechanic, and on June 1, 1914, was advanced to the position of superintendent motive power.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

PORTABLE SPRAY-PAINTING OUTFITS.—Catalog PC, giving concise information and prices on DeVilbiss portable spray-painting outfits, has been published by the DeVilbiss Company, Toledo, Ohio.

INDIVIDUAL MOTOR DRIVES.—A wide range of belt-driven machine tools and other machinery that may be modernized by individual motor drives is illustrated and described in the catalog issued by the Hertzler & Zook Company, Belleville, Pa.

CARNEGIE WHEELS.—The catalog entitled "Carnegie Rim-Toughened Wrought-Steel Wheels," issued by the Carnegie Steel Company, Pittsburgh, Pa., compares the grain structure of treated and untreated wheels, describes scleroscope and Brinell tests, and illustrates the rim-toughening machine and treating furnace.

PIPE TOOLS.—The new No. 32 condensed catalog issued by the Borden Company, Warren, Ohio, lists nine recently added tools and describes outstanding improvements in early models of the Beaver line of pipe tools which are made in various types and a range of sizes from 1/8 in. to 12. in.

ELECTRIC MELTING POTS.—Trent electric melting pots and other electrically heated industrial equipment are illustrated and described in the eight-page bulletin issued by the Harold E. Trent Company, 618 North Fifty-fourth street, Philadelphia, Pa.

LATHES.—The new model Series "O" lathes are illustrated and described in catalog No. 92 issued by the South Bend Lathes Works, 425 East Madison street, South Bend, Ind., which company is now celebrating its twenty-fifth anniversary. A number of practical attachments adapt these Series "O" lathes, of which there are ninety-six sizes and types, to special operations that would otherwise require the purchase of single-purpose lathes.

DRAFT GEAR PRODUCTION.—A 24-page booklet entitled "Miner Draft Gear Production" has been recently published by W. H. Miner, Inc., the Rookery, Chicago. This booklet, generously illustrated, gives an excellent general idea of most of the important operations in the manufacture of Miner friction draft gears from the selection of pig iron and scrap in the storage yards to casting the cylinders and friction elements, manufacturing and testing springs and assembling the complete gears. This booklet is of more than ordinary interest because it shows how thoroughly scientific research has been co-ordinated with service performance and experience covering a 37-year period to produce the friction draft gears made by this well-known company.

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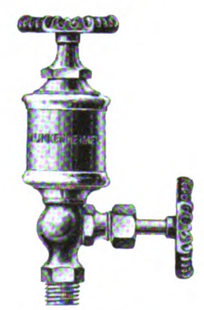

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Railway Mechanical Engineer

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Santa Fe Locomotive 5000 Shows High Sustained Power

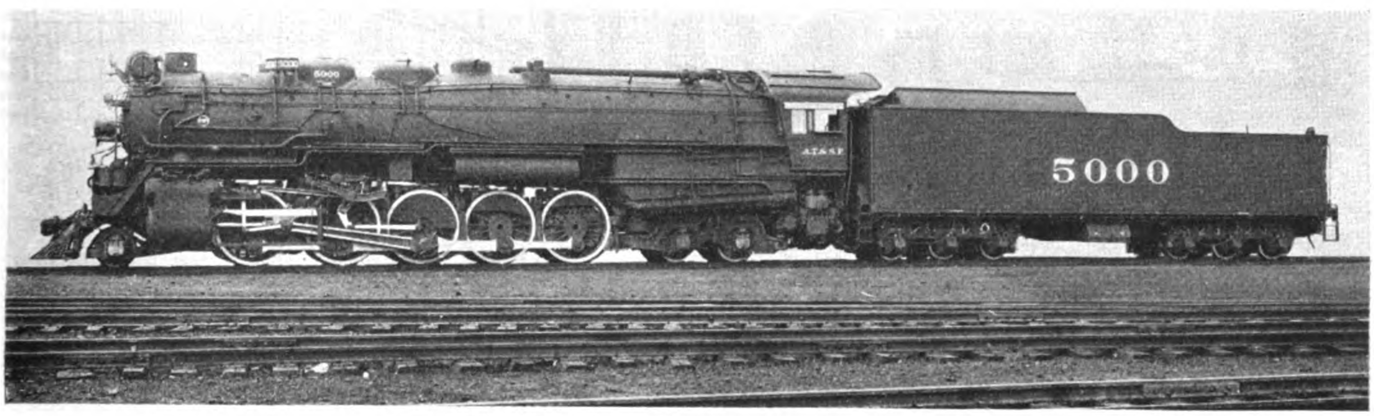
Develops drawbar pull of 82,500 lb. at 15 m.p.h. and 50,000 lb. at 33 m.p.h., equivalent to 4,350 drawbar-horsepower

THE Atchison, Topeka & Santa Fe received a modern 2-10-4 type locomotive, No. 5000, from the Baldwin Locomotive Works in December, 1930, and placed it in service at Clovis, N. M. Subsequently, during the months of July and August, this locomotive was tested with a dynamometer car in freight service on the Pecos division between Clovis, N. M., and Belen, Since Locomotive 5000 was the only one involved in this test, comparisons can be made only with previous tests of other locomotives. As compared with Santa Fe 2-10-2 type locomotives of the 3800 class, for example, tested in the summer of 1930, the new locomotive will handle approximately 15 per cent more tonnage in 9 per cent less time and with 17 per cent less coal per 1,000 gross-ton-miles.

When compared with motive power which was considered strictly modern only about five years ago, therefore, the new Santa Fe 5000-class locomotive promises not only to effect important savings in fuel but to permit handling heavier train loads on shorter schedules. The resultant marked reduction in train-hours per ton handled, tendency to eliminate overtime, and minimizing labor and fuel costs due to delays will have a highly favorable effect upon operating expenses. In addition, the important objective will be achieved of giving better service to shippers.

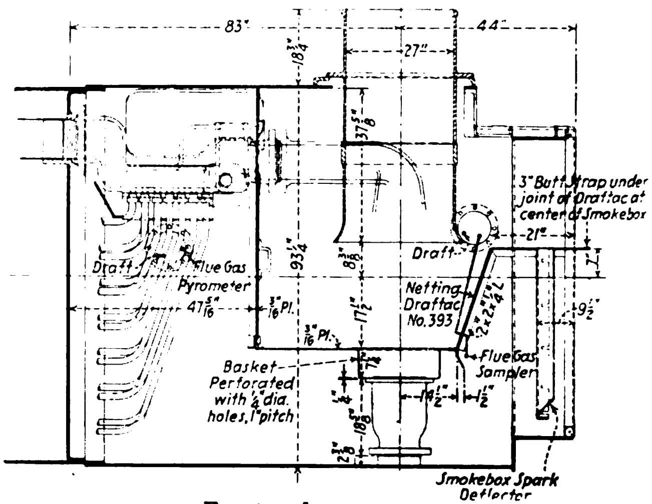
Locomotive 5000 is designed with a greater ratio of boiler capacity to tractive power than is generally used. It is of the 2-10-4 type; carries 300-lb. boiler pressure; and is limited to 60 per cent maximum cut-off. The main steam valves have 3-in. steam lap, 1/8-in. exhaust lap and maximum travel of 9-27/32 in. forward and 9 3/8 in. backward motion.

Special equipment is as follows: Type E superheater; American multiple throttle; Elesco feedwater heater, located on top of the smoke arch; Elesco C. F. pump, located on the left side under the cab deck and back of the left trailer wheels; Standard stoker; Walschaert



Santa Fe locomotive No. 5000 tested on the Pecos division

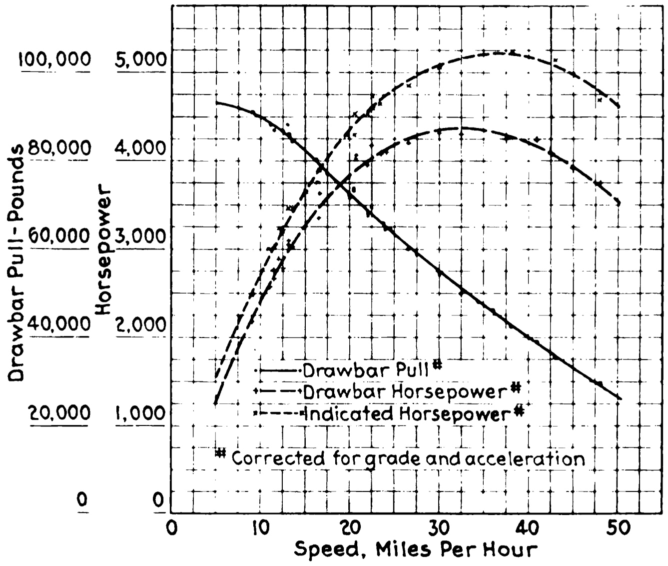
valve gear; Ragonnet reversing gear; Chapman-Lanning auxiliary starting valves; Chicago mechanical lubricator; two Nicholson Thermic Syphons in the firebox and one in the combustion chamber; two 8½-in. cross-compound air pumps, located under the smoke arch inside the line of the main valves and supplied with superheated steam; round-hole table grates, and Muchnic sectional bullring packing, with three sets of bronze rings on each piston head. The engine truck has outside journal bearings. The main rods are of the Lima tandem type. Drawings of the front-end and firebox arrangements are included. The general characteristics and dimensions of the locomotive are shown in a table.



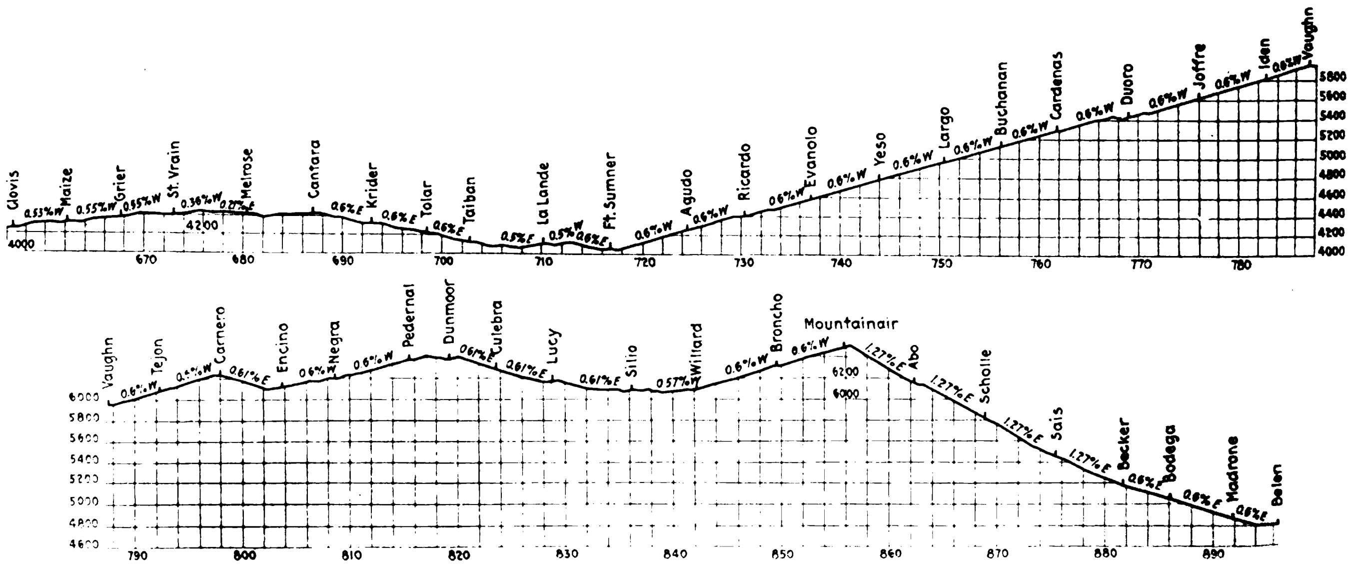
Front-end arrangement

General Characteristics and Dimensions of Santa Fe Locomotive 5000

General classification	2-10-4
Service	Freight
Fuel	Coal
Tractive force, lb.	93,000
Weight in working order, lb.:	
Locomotive:	
Engine truck	41,100
Drivers	348,200
Trailer	113,300
Total	502,600
Tender	283,000
Total, locomotive and tender	877,600
Boiler:	
Diameter, in.	104
Working pressure, lb. per sq. in.	300
No. of 2¼-in. flues	61
No. of 3½-in. flues	350
Length between flue sheets, ft.-in.	21-0
Firebox:	
Length, in.	162
Width, in.	108
Grate area, sq. ft.	121.5
Diameter of stack, in.	27
Number of arch tubes, 3½-in.	2
Number of thermic syphons:	
Firebox	2
Combustion chamber	1
Heating surface, sq. ft.:	
Firebox	443
Arch tubes	22
Syphons	127
Flues, 2¼ in.	750
3½ in.	4,770
Total evaporating surface	6,143
Total superheating surface	2,550
Cylinders:	
Diameter, in.	30
Stroke, in.	34
Piston rod diameter, in.	6
Driving wheel diameter, in.	69
Valves:	
Diameter, in.	15
Maximum travel, in.	9 27/32
Steam lap, in.	3
Exhaust lap, in.	⅛
Exhaust nozzle, Layden, four 3¾ in., later changed to 3⅞-in. openings, equivalent to 7½ and 7¾-in. single nozzles	
Dimensions of journals, in.	
Main	14½ by 13
Front, lateral motion	12 by 14
Others	12 by 13
Trailers	9 by 14
Engine truck	8 by 14
Tender 6-wheel truck	7 by 13
Tender:	
Capacity water, gal.	20,000
Capacity coal, tons	27

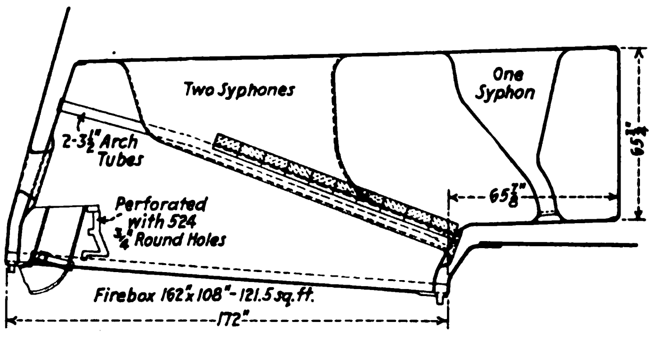


Power performance curves of Santa Fe locomotive No. 5000



Condensed profile of the Atchison, Topeka & Santa Fe, Pecos Division, between Clovis, N. M., and Belen

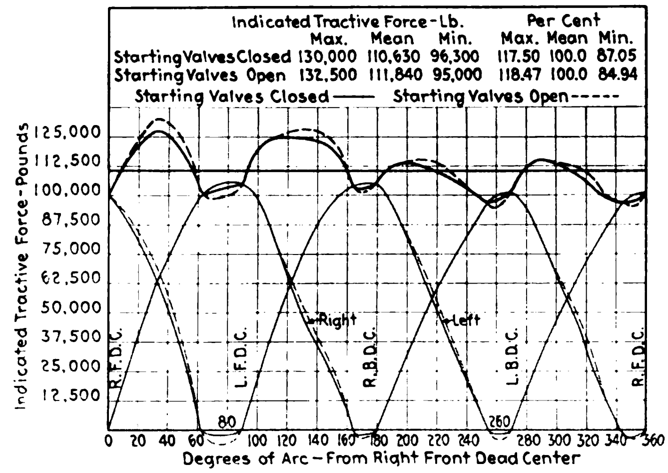
The Sante Fe dynamometer car was used to record drawbar pull, speed, rate of firing, rate at which water was supplied to the boiler, air-brake operations, and time



Cross section showing the large firebox and combustion chamber equipped with three Thermic Syphons

of passing stations, starting and stopping. Cab readings included boiler pressure, steam-chest pressure, back pressure, position of the throttle, reverse gear, temperature of superheated steam entering the valves, temperature of smokebox gases, and the readings of a valve pilot, a device applied by the Valve Pilot Corporation which kept a record of the speed and position of the reverse gear.

Crosby steam-engine indicators were used to determine the steam distribution in the cylinders, and two 4-in. hot-water meters were used, one on the suction line of the pump and the other on the injector, to record the amount of water delivered by either, which was recorded on the chronograph chart. Check readings were also made by means of gage boards on the tender. An electric contact was attached to the stoker conveyor



Indicated tractive-force diagram for locomotive No. 5000

which recorded the revolutions. Temperatures were taken of the feedwater before entering and after leaving the feedwater heater. The amount of cinders thrown from the stack was determined by a catcher in the form of a sector placed over the stack covering about 1.95 per cent of the area, diverting the cinders caught into a container. From the amount of cinders caught, the total amount discharged was determined.

The coal consumption was determined by leveling the top at the beginning of a trip, filling to the same level at the end, and taking the weights shown by the coal-chute scales.

The test was made on the first and second districts of the Pecos division between Clovis and Belen. The ruling grade is 0.6 per cent westbound. Eastbound it is

General Performance of Locomotive 5000 in Freight Service Test Runs on the Pecos Division of the Santa Fe

TRAIN

Run No.	Duration of test: Total time hr.—min.	Duration of test: Running time hr.—min.	Average speed m.p.h.	Train stops, total	Cars ld.—empty	Gross tons	Gross ton-miles, thousands	Total coal, lb.	Water evaporated, gal.	Ratio, water to coal	Coal, lb. per 1,000 ton-miles	Water, lb. per 1,000 ton-miles
Westbound: Clovis to Vaughn, 130.8 Miles; Ruling Grade 0.6 Per Cent												
1	6—36	6—02	21.7	3	51—73	4,130	540.1	47,500	37,412	6:54	88.0	575
3	6—22	5—29	23.8	4	29—103	4,154	544.0	45,500	37,740	6:89	83.6	576
5	7—09	6—10	21.2	4	48—98	4,409	577.0	56,250	41,718	6:16	97.5	600
7	5—27	5—03	25.9	4	56—55	3,765	492.5	44,300	34,663	6:50	89.9	584
9	6—27	6—03	21.6	3	56—81	4,491	588.0	50,399	40,335	6:65	85.5	569
11	8—27	6—02	21.7	5	77—24 77—22	5,055 5,000	656.0	57,300	46,384	6:72	87.3	587
Average	6—47	5—50	22.7	4	53—72	4,327	566.2	50,191	39,709	6:58	88.6	582
Vaughn to Belen, 109.0 Miles; Ruling Grade, 0.6 Per Cent												
1	5—00	4—30	24.2	5	49—72	4,003	436.4	27,500	19,770	5:96	63.0	376
3	4—34	4—01	27.1	3	25—101	3,937	428.0	25,300	17,960	5:89	59.1	348
5	6—33	5—36	19.5	5	45—100 43—100	4,389 4,319	475.5	30,400	23,770	6:49	63.9	415
7	4—57	4—27	24.5	5	56—50	3,660	399.0	23,200	18,140	6:50	58.1	377
9	4—37	4—04	26.8	3	56—81	4,491	489.5	25,400	20,460	6:69	51.9	347
11	6—02	4—47	22.8	7	76—24	4,999	541.0	31,150	25,200	6:70	57.6	386
Average	5—17	4—34	24.2	5	51—71	4,242	461.6	27,158	20,883	6:38	58.9	375
Eastbound: Belen to Vaughn, 109.0 Miles; Ruling Grade, 1.25 Per Cent												
2	6—17	5—56	18.4	3	115—3	5,331	488.2	40,000	29,760	6:18	81.9	506
4	5—36	5—10	21.1	3	120—1	5,720	524.0	42,200	29,000	5:70	80.6	459
6	6—30	5—32	19.7	6	110—8	5,497	507.4	39,750	29,912	6:24	78.3	489
8	4—55	4—30	24.2	4	112—1	5,414	496.0	39,500	28,973	6:09	79.8	486
10	5—03	4—16	25.5	6	64—3 76—4	3,200 4,157	399.8	37,800	28,234	6:20	94.5	586
12	8—50	5—35	19.5	6	129—1	5,999	550.1	55,850	38,385	5:70	101.5	579
Average	6—12	5—10	21.4	5	110—3	5,272	494.3	42,517	30,711	6:01	86.1	517
Vaughn to Clovis, 130.8 Miles; Ruling Grade, 0.6 Per Cent												
2	5—33	4—20	30.2	6	115—3	5,331	697.3	23,600	18,465	6:50	33.8	220
4	5—45	4—49	27.2	6	120—1 123—1	5,720 5,825	754.4	24,900	20,453	6:82	33.0	225
6	4—15	3—56	33.3	5	110—8	5,497	718.0	21,750	15,350	5:86	30.3	177
8	4—42	4—14	30.9	5	112—1	5,414	708.0	19,200	15,687	6:78	27.1	184
10	5—12	4—22	30.0	5	114—8	6,014	787.0	23,050	19,842	7:14	29.3	209
12	5—46	4—22	30.0	3	129—1	5,999	784.0	21,550	16,575	6:38	27.5	175
Average	5—02	4—20	30.3	5	117—4	5,670	741.4	22,341	17,729	6:59	30.2	198

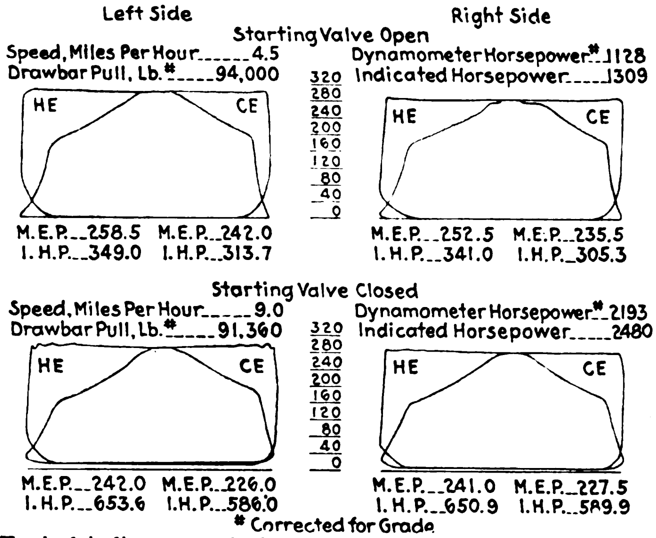
1.25 per cent from Belen to Mountainair and 0.6 per cent from Mountainair to Clovis. Helpers are used on the 1.25-per cent grade, though Locomotive 5000 was used alone on Run 10. A condensed profile of the territory is illustrated.

The locomotive was handled by pool crews which changed at Vaughn going in either direction. The road foreman of engines or the fuel supervisor accompanied all trips to assure uniform handling and full boiler pressure. The locomotive was operated with a wide open throttle where conditions permitted.

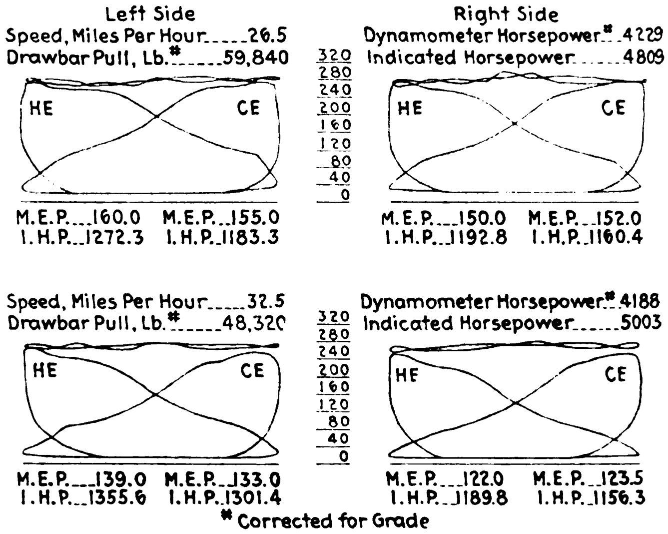
In computing and compiling data taken during the test, the division has been divided at Vaughn and data averaged for each direction on each district for more ready comparison of the locomotive's performance under different conditions.

General Summary—Average of Eastbound and Westbound Runs

Total time on road, hr. min.	5- -50
Total dead time, hr. min.	0- -51
Total running time, hr. min.	4- -59
Speed, m.p.h.	24.7
Train stops, total	5
Train:	
Loads	83
Empties	37
Total cars	120
Gross tons	4,878
Gross ton-miles, thousands	565.9
Work, million ft. lb.	18,086
Total coal as fired, lb.	35,552
Heat value per lb. coal, B.t.u.	12,585
Water from tank, gal.	24,929
Water to boiler, gal.	27,258
Water to boiler, lb.	226,224
Ratio, lb. water per lb. coal	6.39
Coal per 1,000 ton-miles, lb.	66.0
Coal per million ft. lb., lb.	2.03
Water per 1,000 ton-miles, lb.	418
Water per million ft. lb., lb.	12.89
Pressure, lb. per sq. in.:	
Boiler	298
Valve chest	281
Cylinder back pressure	12.4
Temperatures, deg. F.:	
Feedwater entering tank	75
Feedwater entering heater	101.7
Feedwater entering boiler	194
Superheated steam	655
Smokebox	498
Atmosphere	78
Exhaust steam	274
Draft, in. water:	
Header chamber	6.8
Smokebox	9.2
Combustion rates, coal, lb.:	
Total per trip	35,552
Per hr. total time	6,105
Per hr. running time	7,014
Per sq. ft. grate area	57.7
Per sq. ft. heating surface, boiler	2.14
Per sq. ft. boiler and superheater	0.81
Stack loss, lb.	4,809
Per cent of coal fired	13.7
Heat value of cinders, per lb., B.t.u.	8,535
Evaporation rates, water, lb.:	
Actual total per trip	226,224
Actual per hour running time	44,608
Equivalent evaporation from and at 212 deg. F.	
Per hour running time:	
Boiler	47,890
Boiler and superheater	55,442
Boiler, superheater and feedwater heater	60,816
Per sq. ft. heating surface:	
Boiler	7.79
Boiler and superheater	6.39
Equivalent evaporation, per lb. of coal:	
Boiler	6.77
Boiler and superheater	7.83
Boiler, superheater and feedwater heater	8.61
Work performance:	
Mileage:	
Over division	120.04
Working steam	75.09
Drawbar pull, lb.:	
Average over division	28,442
Working steam	44,701
Million ft. lb.:	
Total	18,086
Per mile:	
Over division	150.44
Working steam	236.72
Per 1,000 ton-miles	31.96
Power performance:	
Boiler horsepower:	
Boiler	1,378
Boiler and superheater	1,604
Boiler, superheater and feedwater heater	1,761
Drawbar horsepower	1,833
Water per drawbar horsepower-hour, lb.	24.3
Coal per drawbar horsepower-hour, lb.	3.83
Thermal efficiency, per cent:	
Boiler	52.2
Boiler and superheater	60.4
Boiler, superheater and feedwater heater	66.4
Locomotive at drawbar	5.07



Typical indicator cards for locomotive No. 5000 at speeds of 4.5 and 9.0 m p.h.



Typical indicator cards for locomotive No. 5000 at speeds of 26.5 and 32.5 m.p.h.

This locomotive had an extraordinary capacity for sustained power at high speeds, which is reflected by power performance curves. It exerted a drawbar pull of 50,000 lb. at 33 m.p.h., equivalent to 4,350 drawbar horsepower, at which it had a machine efficiency of 84 per cent. With a drawbar pull of 82,500 lb. at 15 m.p.h., the machine efficiency was 90.0 per cent.

The indicator cards show a very good steam distribution. The pair at 4.5 m.p.h. were taken with the Chapman-Lanning starting valves open at approximately 4½ m.p.h. on a 1¼-per cent grade. The pair at 9 m.p.h. were taken with starting valves closed immediately after the first pair. The indicated tractive-force curve shows the effect of having the starting valve open which admits steam through a 1¼ in.-diameter pipe during the expansion after the main valve has closed.

The tractive force of the locomotive is calculated to be 93,000 lb., which, with a weight on the drivers of 348,000 lb., gives a factor of 3.75. The locomotive has shown over 93,000 lb. at the drawbar.

Cast-Steel Foundations For Railroad Equipment

By William M. Sheehan*

Steel-casting designer has combined many separate parts of cars and locomotives into fewer and stronger units—Inherent qualities of cast steel makes possible the molding of castings of large size and any shape.

CAST steel is unique among the commercial forms of iron and steel in that it is the only one which possesses, within itself, the inherent qualities of homogeneity, unrestricted size and shape, high tensile strength, flexibility of metal distribution, resistance to corrosion and gracefulness of outline. It is the most versatile member of the ferrous group for it combines the strength-giving qualities of steel with the design flexibility and other advantages of cast iron.

One of the outstanding qualities of cast iron is its ability to resist corrosion. This was recently demonstrated at Richmond, Va., where a line of cast-iron water pipe, which had been in use for over 100 years, was found to be in excellent condition and good for many more years of usefulness.

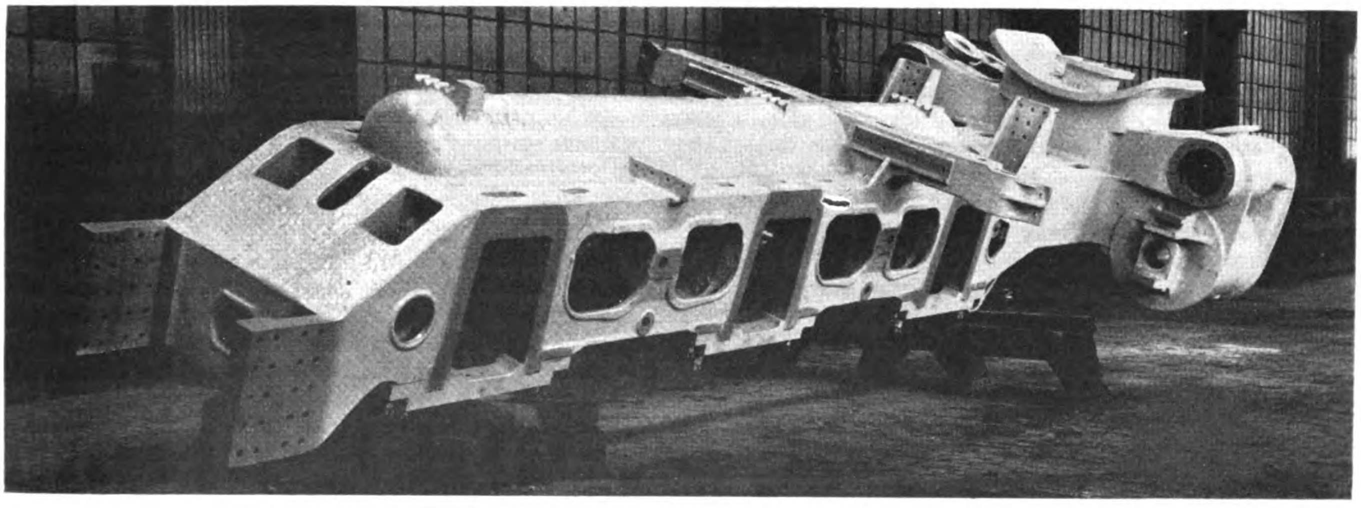
Cast steel long ago demonstrated its ability to withstand a most gruelling corrosive condition in railroad service. After 20 years of continuous use on the Central Railroad of New Jersey, the first two cast-steel locomotive tenderframes, made by the Commonwealth Steel Company in the latter part of 1907, were removed from service to form a part of an exhibit at the Commonwealth plant. A careful examination disclosed that no deterioration had taken place in that time. This, despite the fact that they had been operating along the Atlantic seaboard, adjacent to salt water, and subject at all times to the action of sulphuric acid brought about by the coal and water carried in the tender. In fact, the siliceous coating of molding sand, fused into the surface of the steel and forming its protective skin, was still intact. Another interesting item is that one of these frames had been arranged for the application of rolled-steel side and end sills, and these parts, it was learned, had been replaced a number of times during the 20 years of service.

Water-Bottom Tenders

The maintenance on bottoms of tender tanks has long been recognized as an expensive item. The wooden planks resting on the tender frames become saturated with water and retain it and help to bring about a rapid deterioration of the bottom tank sheet. Then, too, the larger capacity tender tanks required for greater coal and water storage, weaved and buckled, causing leakage and cracking of the tank sheets. It was reasoned that as the cast-steel frame had proven that it would resist corrosion, it was logical to utilize its strength and rigidity as a tank bottom and obtain additional water storage in the space previously taken by the frame and the wooden floor. This was done; the bottom of the frame was cast solid and the tank sides and ends were attached directly to pads on the frame. As a result, about 2,000 additional gallons of water are secured and the coal bunker can also be enlarged. At the same time, tank-bottom maintenance is permanently eliminated and the center of gravity is lowered several inches.

Another innovation in water-bottom tender design utilizing cast steel is the integral-stoker conveyor housing. The practice, since stokers came into use, has been to block off a compartment in the tank in which the conveyor housing was mounted. A considerable por-

* The author is manager of eastern district sales, General Steel Castings Corporation, Eddystone, Pa. This article is an abstract of a paper presented at the November 19, 1931, meeting of the Southern and Southwestern Railway Club at Atlanta, Ga.



Locomotive bed casting with the cylinders and main reservoir cast integral

tion of the tank was thus rendered useless for water storage. The floor of this compartment has to be sealed on water bottom tenders in order to retain the water in the frame beneath it. A number of tenders have recently been built in which the housing, which was of the non-oscillating type, was made of cast steel with end tank walls and side-sheet attaching flanges formed integral. The bottom of the trough formed the roof of a water compartment under the stoker conveyor, and about 500 additional gallons capacity thereby obtained with an actual weight saving on the light tender. At the same time, the stoker mechanism foundation is secured most substantially to the tender frame, thus insuring increased life to the stoker machinery parts. The tank bottom under the conveyor housing is also made easily accessible for cleaning.

Six-Wheel Equalized Trucks

The large locomotive tender involved the use of six-wheel equalized trucks with minimum wheel base and clasp brakes. An analysis of the operating conditions showed the necessity of lateral compensation, so swing motion was provided. The magnitude of these lateral forces is so great that unless they are reduced or neutralized by lateral compensation, the track, wheels, truck and tender must absorb them with inevitable breakage of parts or derailments following.

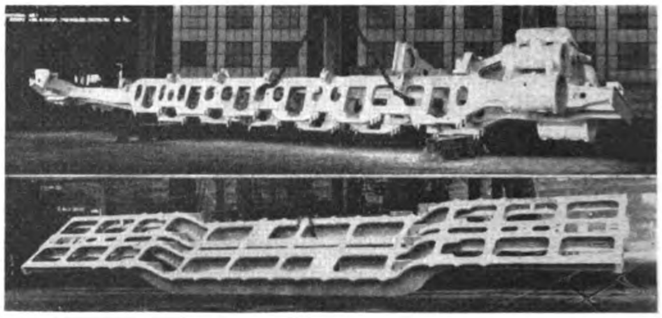
Many improvements have been added to these trucks as a result of suggestions made by those engaged in maintenance. The pedestals are now formed integral, their wearing faces are provided with hardened steel liners, and case hardened pins are used with case hardened bushings applied in all pin holes.

One-Piece Cast-Steel Locomotive Bed

A comparison of the maintenance costs between locomotives equipped with cast-steel beds and others of the same class not so equipped, indicates a maintenance saving at each general shopping of $3,000.00 per engine.

When it was first proposed to cast the cylinders integral with the bed, many railroad men asked what could be done should a corner of a cylinder be broken due to sideswipe. The answer given was that a piece to fit could be cast, welded in place and the cylinder rebored. The preponderance of opinion among railroad officers favored the integral cylinders, it being agreed that breakages due to sideswipe or hydraulic failure could be repaired in this manner. However, after six years of experience, it is interesting to note that although a number of bed-equipped engines have been in accidents, no integral cylinder barrel wall has yet been broken.

A number of beds have been made with the air reservoirs integral and forming the central backbone. It is generally agreed that an improved appearance is secured by removing the reservoirs from beneath the running boards, but, in addition, their removal eliminates the possibility of their being punctured when a rod or piece of motion work breaks. The corrosive resistant surface of the cast-steel reservoir also insures a protection against deterioration due to condensate and viscous masses reposing on the bottom of the inside of the reservoir. The utilization of the integral reservoir as the backbone of bed permits a thicker wall which increases the safety feature. An officer of one of the railroads using this construction advises that a considerable saving is obtained at shopping as less work is involved.



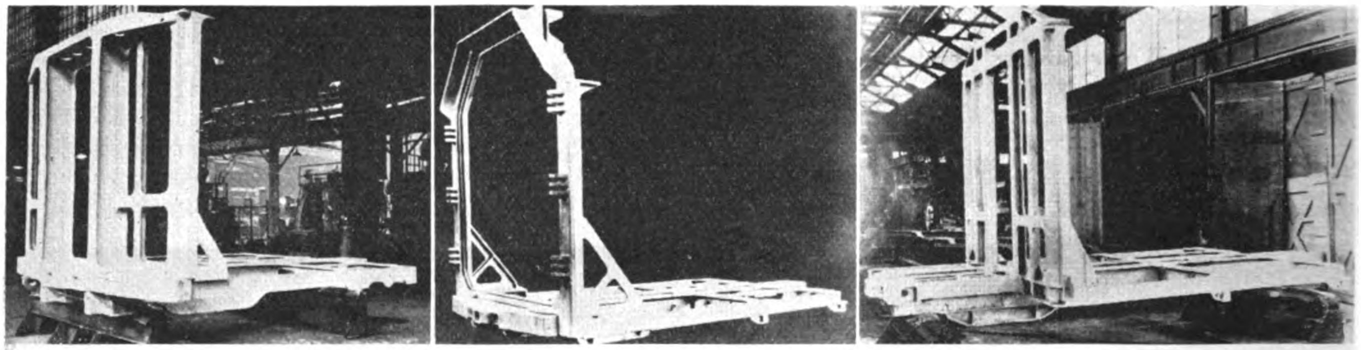
Top: A large locomotive bed casting—Bottom: Foundation for well-car for transporting transformers and heavy machinery

There have been a number of beds recently made with the rear cylinder heads and guide brackets formed integral and this construction will eliminate the difficulties now experienced at this point.

There are now over 1,100 steam locomotives equipped with beds in use in all kinds of operating service and on every type of modern power, from the six-wheel switcher to the heavy Mallet. Thirty-six roads are now using them.

The first locomotive beds were applied by the New Haven in 1918 to passenger electric locomotives operating between New York and New Haven, Conn. Each of these locomotives has two beds. Ten locomotives recently built by this road have not only beds but also one-piece cast-steel cab underframes and guiding trucks. All of the Pennsylvania locomotives to operate in the newly electrified zone between New York and Washington, D. C., are being equipped with one-piece beds. The most complicated casting so far made for railroad equipment is the bed for the Diesel electric locomotive built for the Canadian National.

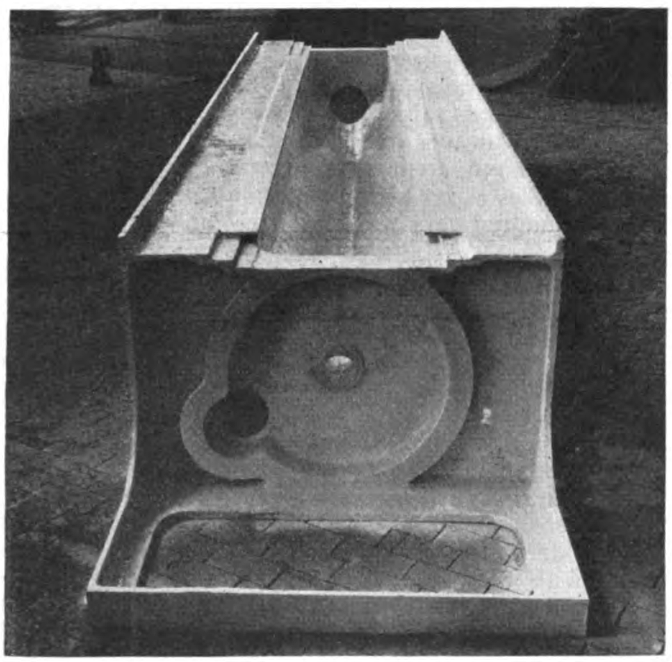
The cast unit with its greater uniformity of section



Three designs of end construction for passenger cars—Left: Vestibule-platform design—Center: Casting for blind-end express and baggage cars—Right: Open-platform design

permits the metal thicknesses to be just the amount required and these can be gradually tapered as the stresses change; corners can be rounded and abrupt changes in shape obviated. This allows economy of material and removes the tendency to localized stresses as often exist where two or more layers of metal are used in the built-up construction. Then, too, a gracefulness is permitted in the shape of the cast unit not possible in a job fabricated by bolting, riveting or welding. Beauty of outline is an object to be always sought where strength requirements are not affected. One is immediately impressed with the rugged, yet more graceful appearance of the one-piece locomotive bed when it is compared with the built-up, bolted construction displaced.

When a locomotive strikes a motor vehicle at a grade crossing, it not only, in most cases, wrecks the car and injures or kills the occupants, but oftentimes, the projecting coupler impinges the side of the automobile above the running board and carries it along the track, frequently forcing a portion of it under the engine-truck wheels, thus causing a derailment. The cast-steel pilot and drop coupler have been developed in order to throw a motor vehicle from the right-of-way when the locomotive strikes it. Except when the coupler is in use, it is dropped into a recess in the pilot which then



Integral stoker conveyor housing

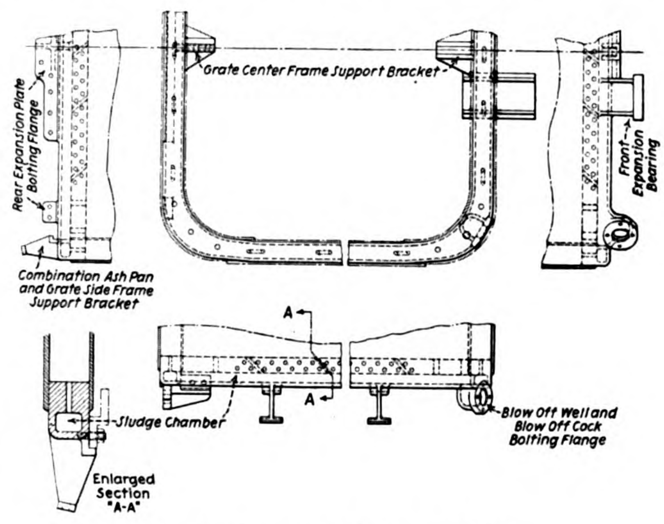
presents substantially concial deflecting surfaces. This coupler has a counter-balanced portion at the rear which, when in dropped position, seats against a cross-beam on the footplate and serves as a backbone for the pilot. The counterbalancing feature permits the couples to be easily raised or lowered by means of the uncoupling lever. The pin which passes through brackets on the pilot and body of the coupler, when in coupling position, also serves as a retainer for keeping the coupler in dropped position when inoperative.

Steel Castings in Boiler Construction

The development of higher-pressure boilers offers many opportunities to the steel casting designer for boiler improvements. The flexibility of form which castings give will, it is believed, be of great utility in future boiler design. Steel castings are being used today with success as turbine casings and other high pressure steam containers and the experience thus obtained proves conclusively their feasibility. The use of cast steel in boilers is especially desirable as with its corrosive resisting qualities, it will give longer life to the part for which it is adapted.

The New Haven has a number of locomotives equipped with cast-steel smoke boxes. These permit a flat base for the cylinder attachment, incorporate the smoke-box front and the brackets for the diaphragm and netting, as well as the other appurtenances. The depressions in the smoke box for the feed-water heater or steam pipe can be formed integrally with ease.

One-piece cast-steel solid mud rings, have for some



One-piece cast-steel solid mud ring

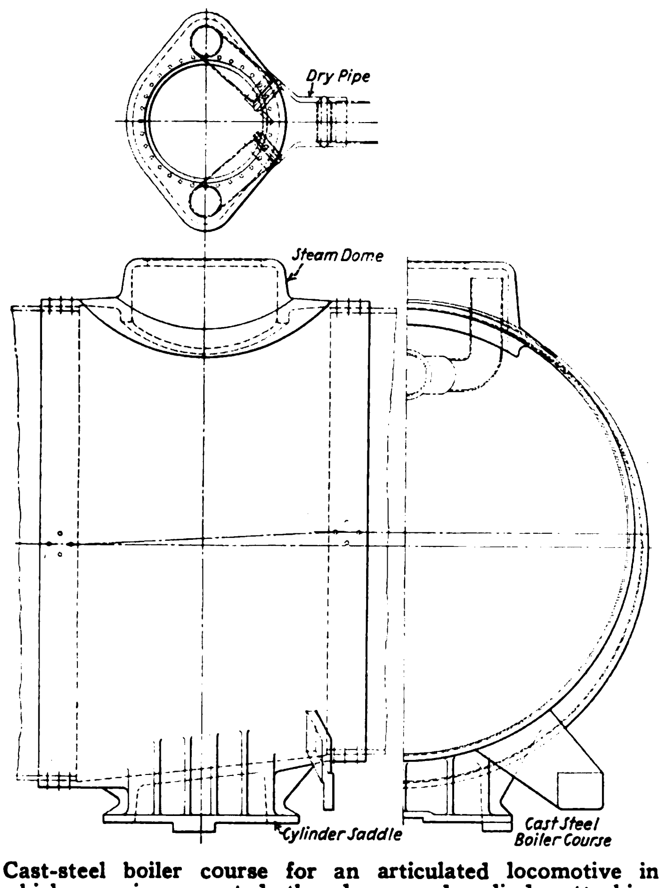
time, been the usual construction but it is now proposed to cast a hollow chamber in the lower portion of the ring below the fire-box sheet rivets and connect this chamber to the water legs by holes spaced between the fire-box rivets and thus form a sludge receiver. The blow-off cocks would be attached to the bottom of the ring at the front end and connected to this chamber and when the cocks were opened, would discharge any accumulated sludge from the chamber. This would keep the top of the mud ring free from solid matter.

On an articulated locomotive, it is inadvisable to attach the cylinders of the rear unit directly to the boiler as that portion of the boiler is filled with tubes and flues which would have to be removed in order to detach the cylinders. The usual practice is to apply a shallow saddle to the underside of the boiler and attach the cylinders to the bottom of this saddle. Usually, the dome is applied at the top of this course. A construction has been developed which incorporates, in one cast-steel piece, the dome, the boiler course and cylinder-attaching bracket. In this way, the present difficulties attendant in rear cylinder attachments for articulated locomotives are removed, and at the same time, the longitudinal seam and the reinforcing liners between the boiler course and separate dome and saddle are eliminated. The circumferential joints for connecting adjacent courses are machined to insure a good fit. There have been instances where the dome would have been better if made in a form other than cylindrical. In the cast structure, the dome can be any shape that may be desired.

Cast-steel equalized swing-motion trucks embodied the first large integral steel castings utilized on railroads. The first of these were applied in 1905

and since then, many improvements have been made in passenger-truck design to secure better riding and to permit easier inspection and maintenance. Both four- and six-wheel trucks are now made with straight equalizers which put the brake shoes in the clear, making possible easier and quicker inspection and renewal of shoes. Pedestals are also now cast as a part of the truck frame and their wearing surfaces protected by renewable hard-steel liners. On six-wheel trucks, the side bearings are cast integral with the truck center bolster, permitting an inside side bearing and eliminating the outside bearing arch.

One of the worst forms of accidents which can happen to a passenger train is a telescoping collision in which one car climbs over the platform of the adjacent car and, due to the impact, shears the end posts and roof members and penetrates the body of the car. The results in a passenger coach are horrible to contemplate and while, thanks to efforts for efficient and safe operation, these accidents are not common, still, unfortunately, they sometimes occur.



Cast-steel boiler course for an articulated locomotive in which are incorporated the dome and cylinder-attaching bracket

The desire to prevent such catastrophes led to the development of the cast-steel passenger-car end construction. In this, the end frame of the car is a rugged unit with a substantial connection to the platform and with upright door and corner posts joining the top and bottom sills. This top sill is attached to the roof and side members. The upright posts will withstand a blow of one and one half million pounds struck 18 in. above the floor without fracturing and the tensile value of the top sill prevents the roof being rent asunder. Many roads have adopted this construction for both vestibule and blind-end cars, convinced that such effective insurance against a telescopic collision is most desirable. A modification of this end construction has also been developed for wide door express cars.

Cast Structure Has Distinct Function

It is believed that the cast structure has a distinct place in industry that will not be taken by any fabricated alternate. The trend of machine design for some time has been toward units and actual molecular unity in complex shapes is not assured in any forms other than castings or forgings.

The casting process permits metal to be placed exactly where it is needed for strength and in just the required amount. Laps, seams, and joints, which are necessary in all fabricated forms, are eliminated. A bolted or riveted structure forces the designer to compromise with proper sections and metal distribution to provide clearance for the application of bolts or rivets and also to make allowance for material removed for the bolt or rivet holes. Every user of machinery knows that a considerable proportion of the failures he encounters is through these holes and is often caused by the looseness of individual bolts or rivets.

Freight-Car Foundations of Cast Steel

The demonstrated ability of the cast-steel tender frame to withstand corrosive action naturally caused a similar cast structure to be considered where corrosive deterioration was being experienced in other railroad equipment. Gondola cars with built-in underframes, used for the transportation of bulk sulphur in the southwest were subject to especially high upkeep charges due to the acid formation and their underframes required frequent renewals. The Santa Fe, which handles a considerable portion of this traffic, has several hundred cars with cast steel underframes now in use.

It was a logical sequence of these developments that a one-piece underframe of cast steel should be made for coal-carrying cars. One of the large coal-carrying roads has recently placed in service some 50-ton gondola cars with this type of foundation. These have a single center sill connecting the bolsters. The casting process permitted this single member of required area to be used with integral crossties at intervals connecting it to the side sills.

A more ambitious project, but one which promises still greater savings, is the cast-steel hopper-car underframe with integral hoppers and door frames. Hopper-car foundations are badly punished in two ways. Not only do the draft sills and bolsters have to withstand the heavy end loads resulting from run-ins and bumping in classification yards, but the entire frame structure between the end-slope sheets is subject to severe corrosive action. The numerous joints, bends and seams in the hopper zone provide pockets and caches where the concentrated sulphuric acid, resulting from the moisture and coal, can lodge and rapidly eat away the rolled-steel plates. An examination of hopper cars on any repair track bears out this statement. The cast foundation, with its seamless hopper walls and acid resistant surface, should function indefinitely.

The bulk movement of petroleum products, to secure lowest operating cost, requires a greater capacity car of nominal length and a low center of gravity. The distance from the rail to the top of the cylindrical tank is limited. The usual type of underframe, with the longitudinal sills below the tank, restricts the tank diameter. The cast-steel tank car bottom, forming the lower segment of the tank and containing within itself the buffing and pulling column, substantially increases the

available tank diameter without increasing the distance from the rail to the top. This permits a much greater volume in the given length and a lower center of gravity. Here, again, the protective surface of the casting is especially advantageous for the transportation of acids and high sulphur content oils. The Santa Fe has a considerable number of cars built in this manner.

The railroads engaged in handling iron ore from the mines in northern Minnesota and Wisconsin to Lake Superior ports have a peculiar problem in car construction to meet. On account of the spacing of the hatches in the ore boats being 12 ft., the pockets in the docks must have the same spacing, and the economic length over coupler pulling faces of the ore cars has been established as 24 ft. These cars have a single-center hopper, the entire load of 75 tons being self-clearing in less than one minute. No center sills are permitted, so the vertical and longitudinal forces must be carried through the side sills, and transversely, to the center plates and draft sills. The cast steel underframe has been successfully embodied in several hundred of these cars.

Caboose and Special-Service Cars

Roads traversing regions where pusher locomotives are needed, have a problem to secure a caboose car, which, when placed between the rear of the train and the pusher, will be safe and free from vibration. It is the practice on many roads to place the caboose behind the pusher. This requires two switching movements which could be eliminated if a more substantial caboose car underframe were used. The cast steel underframe on the Reading's caboose cars solves this problem satisfactorily.

The task of handling large transformers and other electrical equipment, as well as machinery and other large units, without dismantling, requires a drop center car with a minimum distance from the rail to loading platform. Cars of this type with a built-up underframe have shown high maintenance costs, particularly in the curved offset portion, and in order to obviate this, the cast foundation was developed. One of the large western roads, a few years ago, had need for some flat cars of 200-tons capacity, and selected the one-piece cast-steel frame. These cars were built with eight-wheel trucks.

Air-dump cars used extensively in maintenance-of-way or construction work and wherever self-clearing side unloading is required, present an underframe problem of great difficulty. These cars usually have two large air dump cylinders on each side attached to the center sill. When the load is expelled by these cylinders lifting one side of car, there is a severe twist set up in the center sills between the bolsters and cylinders. These torsional forces have been most effectively met in the integral cast underframe, as this structure presents a box section with strength members at the points of maximum stress.

The general use of humps in classification yards and the larger and heavier freight cars with their greater loadings, make it imperative that underframes be stronger. The limitations of the fabricated or built-up frames are becoming increasingly evident. Freight car truck side frames and bolsters are made of integral-steel castings, and the center plates are cast in one piece with the bolsters. The heavy end shocks, tending as they do, to move the car body longitudinally on the trucks, in a short time loosen the body center plate rivets. These rivets, which have the added duty of tying together the bolster bottom cover plate, bolster diaphragms, center sills and center sill fillers, are important elements at a vital point on the car. Their frequent failures due to looseness hastens disintegration of that portion of the underframe. On the one-piece freight-car foundation, the center plates are cast integral with the underframe and are effectively braced by the internal structure of the bolster.

One of the large eastern railroads serving the automobile industry, to meet the problem of motor-traffic competition and to give better service to automobile manufacturers, has developed a car of increased cubical capacity. This allows the maximum number of auto-

(Continued on page 584)

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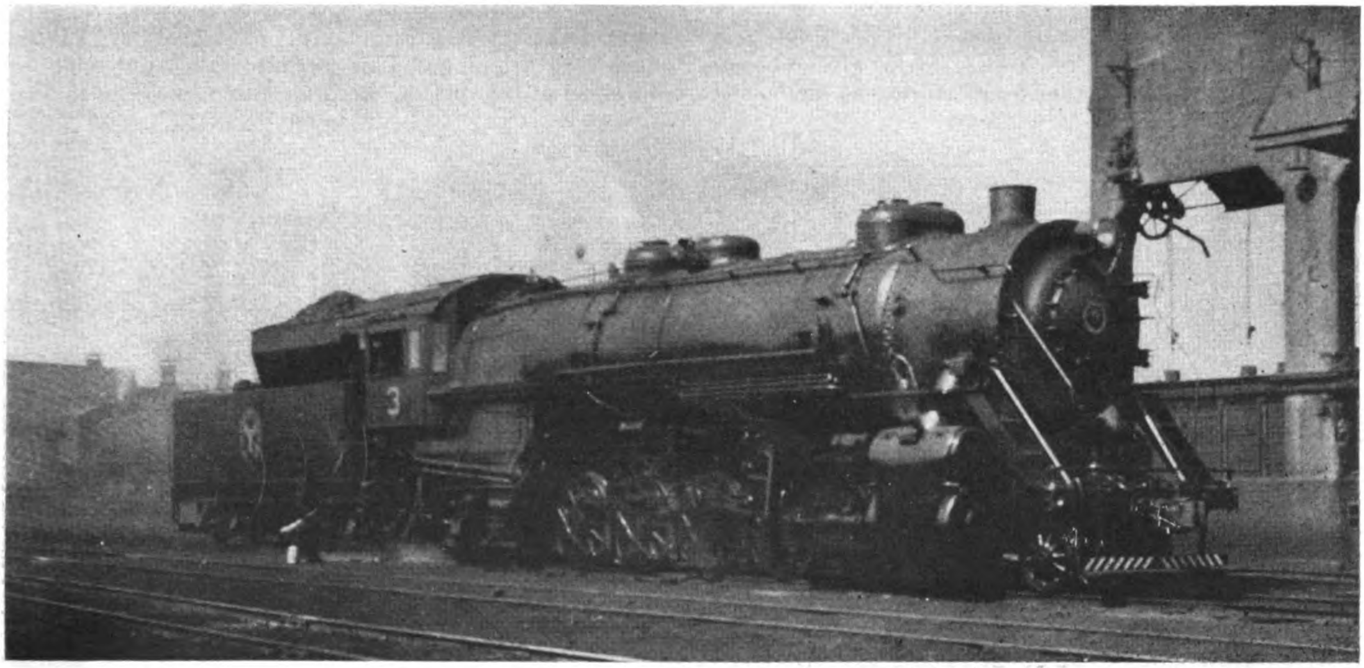


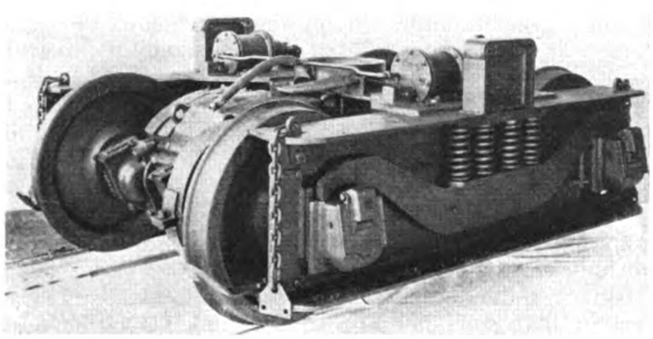
Belt Railway of Chicago locomotive with white stripes painted on the foot boards as a safety measure

Oil-Electric Switchers For the Bush Terminal

Powered with 325-hp. Ingersoll-Rand oil engines—Locomotives exert 22,600 lb. tractive force at one-hour rating — Electric-arc welding was used in the construction of the cab, underframe and trucks

SEVEN 60-ton, 300-hp. oil-electric locomotives were recently placed in switching service by the Bush Terminal, New York. These switch engines, which were built by the General Electric Company at its Erie, Pa., plant, are powered with Ingersoll-Rand 10-in. by 12-in. six-cylinder oil engines, developing 325 b.hp. at 550 r.p.m. The engine is directly connected to a G. E. DT-515 differential-compound generator. The tractive force at 3.5 m.p.h. is 22,600 lb. at one-hour rating. Other important dimensions and weights are shown in the table.

While adhe:ing to well-established practice so far as the engine and the electric equipment are concerned, new features have been embodied in the design and construction of the cab, underframe and trucks, which are fabricated entirely from structural-steel shapes and plates, and arc welded throughout. There are no rivets, and bolts have been used only for those parts requiring occasional removal or renewal.



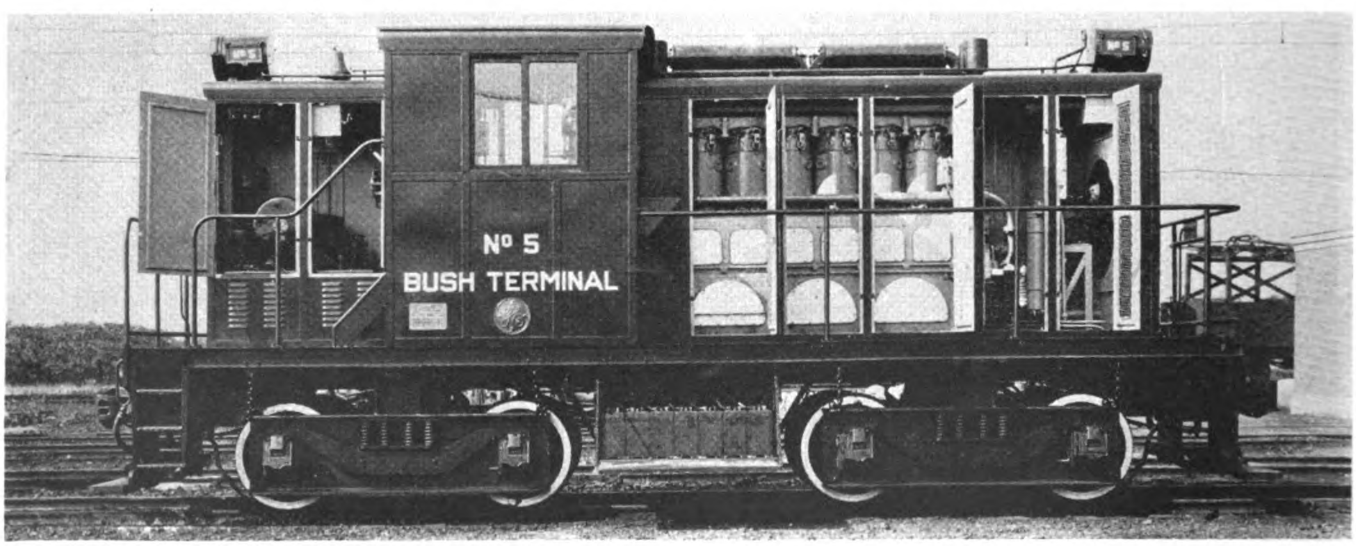
All-welded truck with the motors installed

Frame and Cab Construction

The truck frame consists essentially of three members; two side frames of 26-in., 151-lb. girder beams, with a 22-in., 108-lb. girder beam serving as the bolster. The bolster beam is welded directly to the side members, the joint surfaces being reinforced with heavy gusset plates and brace plates. All welds are continuous and, except at a few minor points, all welds on the truck have been made with type R heavily coated electrode. The load is carried to the journal boxes through double equalizer bars located on either side of the girder-beam web. It is transmitted to each bar through four helical springs.

The platform or underframe has two 14-in., 100-lb. H-columns for center sills with intermediate and side sills of 6-in. channel. The engine is mounted directly on these center sills so that, in addition to taking the buffeting stresses, they afford also a rigid support for the power plant. For end sills 1½-in. plates are used. A ⅜-in. deck plate extends over the entire platform and is attached to the longitudinal sills by ⅜-in. intermittent welds on a 10-in. pitch. End plates are attached by ¾-in. continuous welds. The body bolsters are attached to all four sills by ¼-in. continuous welds.

The cab structure consists of a framing made of 2-in. T-sections with continuous welds at all joints. The side and roof sheets are attached to this structure by intermittent welds on a 6-in. pitch, except at the outer surface of the side sheets where, to provide water-tight joints, continuous welds are employed. As will be noted from the illustrations, the side sheets are placed inside the framing. This permits tying the edge of the sheet at two places, the intermittent weld on the in-



Bush Terminal locomotive No. 5 with the side doors of the cab open to show the location of the engine and control equipment

Bush Terminal locomotive No. 2 as it appears in service

side and the continuous weld on the outside. In addition, the backs of the T-section, projecting through in this manner, produce a panel effect in the cab wall and break up what would otherwise be a monotonously plain surface.

Cab and Control Arrangement

Instead of the usual box cab which has heretofore characterized most oil-electric locomotives a modified steeple, or hood type, cab has been adopted. The engine and a small portion of the generator are enclosed by the long hood, with the remainder of the generator projecting into the main cab. The control equipment, the air compressor and the fuel tank are located under the short hood at the opposite end. A tubular type

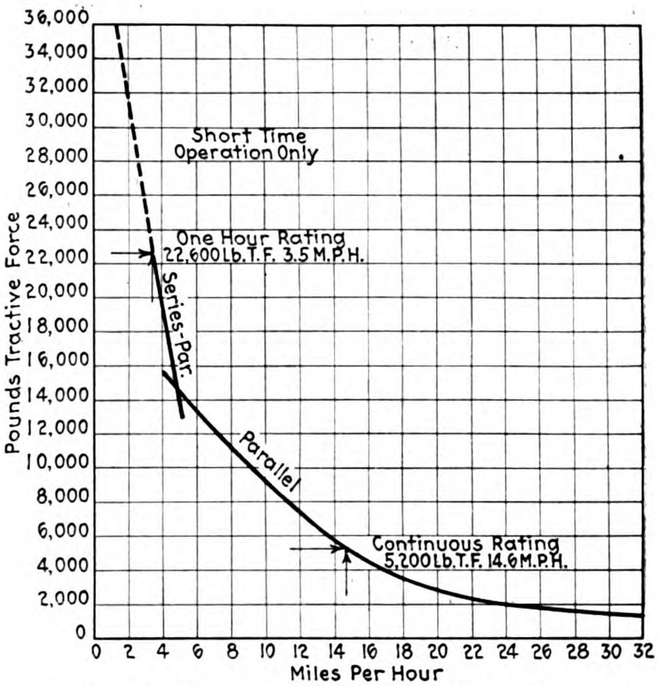
Dimensions and Weights of the Bush Terminal Oil-Electric Switchers

Railroad	Bush Terminal
Builder	General Electric Co.
Type of locomotive	B-B (Electric classification)
Service	Switching
Oil engine:	
Builder	Ingersoll-Rand
Cylinders, diam. and stroke	10 in. by 12 in.
Cylinders, number	Six
Brake horsepower	325
Generator, type	G. E. DT-515
Traction motors, type	(4) G. E. HM-838
Weight, light	117,500 lb.
Weight, in running order	120,000 lb.
Wheel bases:	
Rigid	6 ft. 6 in.
Total	22 ft. 6 in.
Length, inside knuckles	34 ft. 6 in.
Height, overall	13 ft. 8½ in.
Width, overall	9 ft. 6 in.
General data:	
Horsepower rating	300
Tractive force, one-hour rating	22,600 lb.

radiator consisting of 14 sections is built integral with the front end of the engine hood. Air is drawn through this radiator and discharged through the screen doors at the sides by a 42-in., propeller-type fan directly driven by a 900-r.p.m. series motor. The sides of both hoods consist entirely of hinged doors and on top of the engine hood there is a hinged hatch cover which may be thrown back or locked partially open for ventilation.

In the main or operating cab there are two control stations located in diagonally opposite corners. To provide better visibility, the floor is raised above the main deck, which brings it about to the center line of the generator around which it is fitted. About 70 per cent of this floor area consists of a hinged trap door which, when raised, gives access to the lower half of the generator.

This hood type cab and the location of the apparatus therein have been designed with a view of affording

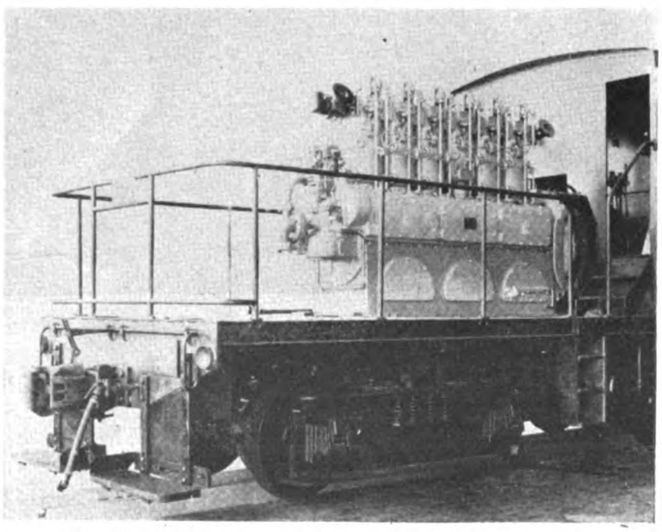


Speed-tractive-force characteristic of the 300-h.p. Bush Terminal switchers

maximum accessibility to all parts of the equipment. All routine inspection and maintenance operations may be carried on through the doors of the hoods, and also most overhauling jobs like the renewal of crank-shaft bearings, etc. Through the hatch in the top, the cam shaft and valve mechanism may be adjusted and cylinder heads, pistons, etc., may be removed. The engine hood is bolted on so it may be removed entirely, thus completely exposing the engine. The whole power plant may then be lifted off or, if no crane is available, it may be rolled off endwise onto a flat car.

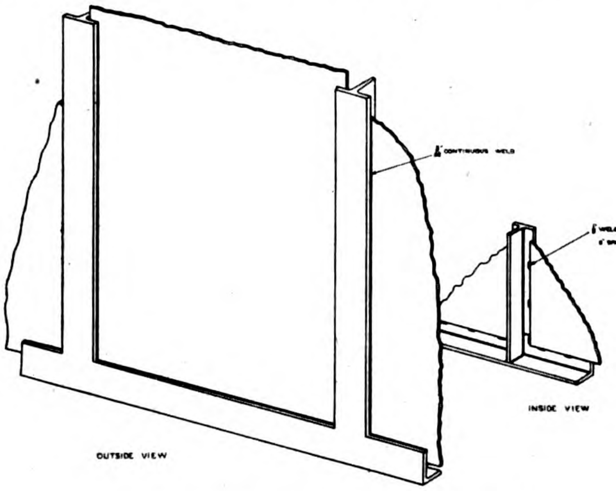
Engine and Power Transmission

The Ingersoll-Rand engine is directly connected to a DT-515 differential compound-wound, commutating-



Portion of cab removed showing the oil engine

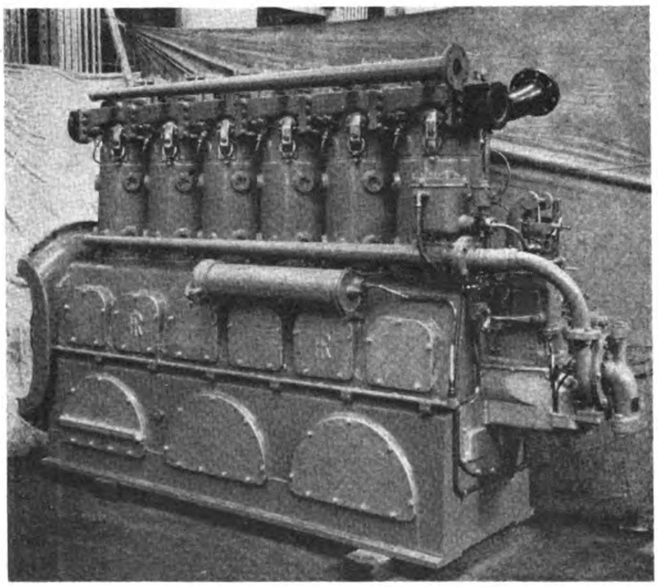
pole, direct-current generator, on the shaft extension of which is a 125-volt auxiliary generator for exciting the main field windings, supplying power for the auxiliary equipment and charging the storage battery. This battery consists of 56 cells of 100 amp. hr. capacity and serves for engine starting, lights and for control operation. The four traction motors are G. E. HM-838, box-frame, commutating-pole type with roller-bearing



Detail showing the cab wall construction

armatures. They are mounted directly on the axles, drive through single reduction gearing and have nose support on the truck bolster.

Several new features have been incorporated in the design of the oil engine with which the seven new Bush Terminal switchers are equipped. An important feature is an improved design of cylinder head to effect smokeless combustion. Both the intake and exhaust manifolds are incorporated in the cylinder head, which



Ingersoll-Rand 10-in. by 12 in. oil engine

is arranged so that air is admitted to the cylinder directly from the intake manifold and the gases are exhausted directly to the exhaust manifold. The fuel oil is injected into the combustion chamber through two spray nozzles which are arranged so that the sprays impinge against each other at the center of the combustion spaces. This impinging action causes a thorough mixture of oil and air, thus insuring complete combustion with the resultant absence of smoke from the exhaust.

Improvements have also been made to the system of lubrication, the system of fuel-oil distribution and injection, electrical engine control and mufflers. The connecting rod used is a solid steel forging of the marine type having a solid end with a round bearing at the piston connection. This design is simpler and easier to maintain than the connecting rods used in previous installations where the piston end of the rod had a box-type bearing secured with four studs. The main-bearing assembly is held in place by means of a wedge and pedestal arrangement very similar to that used on steam locomotives and with the maintenance of which railroad-shop mechanics are familiar.

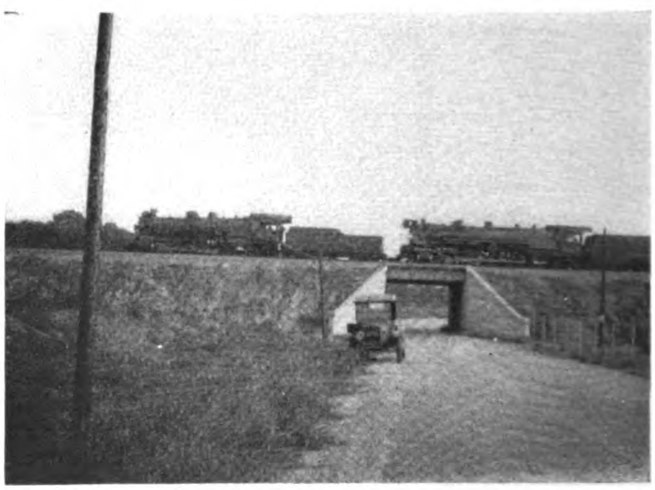
Control Equipment

The control equipment is G. E. Type M, consisting of electro-magnetically operated contactors for changing motor combinations and electro-pneumatically operated reverser for changing direction. Two motor combinations are provided: The first with all four in series and the second grouped series-parallel. The speed of the locomotive is controlled entirely by movement of the engine throttle handles at the control stations. Aside from the two air-brake valves and the small controller handle for reversing, the engineman has only this throttle handle to operate, the transfer of motor connections from series to series-parallel being effected automatically.

This automatic change-over functions with the voltage of the generator and is arranged so that it occurs at such a point that full capacity of the engine is available for either motor combination. At each control station there is an illuminated panel on which are mounted air gages, engine-temperature and oil-pressure gages and a traction-motor ammeter. Along with this, a group of push-button switches provides the engineman with control of the headlights and the radiator-fan motor.

The air brake equipment is Westinghouse Schedule 14-EL straight and automatic with air supplied by a CP-130, 50-ft., motor-driven compressor. Four brake cylinders are used—two on each truck, which are mounted on top of the truck frame and connected directly to the foundation brake levers. The air-sanding equipment is supplied with sand from boxes located at the ends of the platform. These are filled through large sand doors fitted into the deck plate.

* * *



Old and new power on the Texas & Pacific at Fort Worth, Tex.

Examples of Recent Locomotives of the 4-8-4 Type

General Dimensions, Weights and Proportions

Railroad	A.T. &S.F.	A.T. &S.F.	A.T. &S.F.	D.L.&W.	D.L.&W.	N.P.	C.N.	C.N.	C.N.	G.T.W.	C.P.	C.R.I. &P.	D.&R. G.W.	G.N.	G.N.	C.& N.W.	C.M St.P.&P.
Road class	......	......	......	......	......	......	U-2a	U-2b	U-2c	U-3a	K-1a	R-67-B	M-64	S-1	S-2	H	S-1
Road number	3,751	3,755	3,751	1,501	1,603	2,607	6,100	6,131	6,151	6,300	3,100	5,000	1,702	2,552	2,577	3,006	9,700
Builder	Bald.	Bald.	Bald.	Amer.	Amer.	Amer.	Can.	Mont.	Mont.	Amer.	R.R.	Amer.	Bald.	Bald.	Bald.	Bald.	Bald.
Date built	1927	1928	1929	1927	1929	1927	1927	1927	1929	1927	1928	1929	1929	1929	1930	1929	1930
Tractive force, engine, lb.	66,000	66,000	66,000	64,500	71,600	57,500	56,800	56,800	56,800	60,200	60,800	66,700	63,700	67,000	58,300	65,200	60,000
Tractive force, booster or aux. loco., lb.	......	......	......	......	......	11,400	......	......	......	......	......	13,100	......	......	......	11,300	....
Cylinder horsepower (Cole)	3,406	3,406	3,406	3,280	3,317	2,965	2,928	2,928	2,928	3,120	3,221	3,042	3,148	3,530	......	3,280	......
Piston speed at 10 m.p.h., ft.	230.2	230.2	230.2	232.8	256.1	230.2	230.2	230.2	230.2	230.2	224.1	259.7	240.1	230.2	......	235.8	......
Engine and Tender Data																	
Weight of engine, lb.	421,900	428,210	432,240	421,000	418,000	426,000	379,000	381,900	383,000	399,000	423,000	434,000	408,500	472,120	420,900	498,000	450,840
Weight on drivers, lb.	269,400	272,100	272,880	262,000	262,000	260,000	230,000	233,400	232,200	234,500	250,000	265,500	252,000	273,700	247,300	288,000	258,815
Weight on front truck, lb.	64,600	63,520	65,410	62,500	65,500	62,000	65,000	63,200	66,500	66,000	61,000	68,000	64,000	88,820	78,000	87,000	79,330
Weight on trailing truck, lb.	87,900	92,590	93,950	89,500	90,500	104,000	84,000	85,300	84,300	98,500	112,000	100,500	92,500	109,600	95,600	123,000	112,695
Weight of tender, loaded, lb.	287,400	288,090	292,260	216,000	289,000	313,000	271,500	270,500	274,600	267,500	286,000	299,200	269,500	375,780	316,900	320,000	289,160
Tender, water capacity, U. S. gal.	15,000	15,000	15,000	12,000	15,000	15,000	13,800	13,800	13,200	13,550	14,400	15,000	14,000	22,000	17,000	18,000	15,000
Tender, fuel capacity, tons or gal.	20	20	20	14	22	24	20	20	20	20	18½	20	20	5,800	5,800	20	20
Wheel base, driving, ft. and in.	19—0	19—0	19—0	20—0	19—0	20—3	19—6	19—6	19—6	19—6	19—9	19—3	18—9	19—0	20—9	20—6	19—9
Wheel base, engine, ft and in.	44—0	44—0	44—0	46—8	45—6	47—2	43—10	43—10	43—10	43—10	45—9½	45—7	44—5	45—6	47—9	48—7	46—3
Wheel base, engine and tender, ft. and in.	87—2⅛	87—2⅛	87—2⅛	82—2½	84—7½	90—0	82—4¾	82—4¾	82—2¼	82—4¾	87—0¾	88—0	89—9	94—10¼	91—2	91—1	88—4½
Cylinders, diameter and stroke, in.	30x30	30x30	30x30	27x32	28x32	28x30	25½x30	25½x30	25½x30	26¼x30	25½x30	26x32	27x30	28x30	29x29	27x32	28x30
Driving wheels, diameter, in.	73	73	73	77	70	73	73	73	73	73	75	69	70	73	80	76	74
Boiler Data																	
Steam pressure, lb.	210	210	210	250	235	210	250	250	250	250	275	250	240	250	225	250	230
Fuel	Coal	Coal	Coal	Soft coal	Soft coal	Sub.B.coal	Soft coal	Soft coal	Soft coal	Soft coal	Soft coal	Soft coal	Soft coal	Oil	Oil	Soft coal	Semi-Lig.
Boiler, diameter, first ring, in.	88	88	88	84¼	84¼	82 7/16	82 7/16	80⅞	80⅞	83	96½	84¼	84	88	84	90 3/16	88
Firebox, length, in.	144	144	144	132	132	162	126⅛	126⅛	126⅛	126⅛	140 3/16	132⅛	132⅛	144	138	150⅛	137
Firebox, width, in.	108	108	108	96¼	96¼	102¼	96¼	96¼	96¼	96¼	96	96¼	96¼	102	102	96¼	108¼
Tubes, number and diameter, in.	59—2¼	57—2¼	57—2¼	285—2	278—2	33—3½	27—2¼	27—2¼	42—2¼	201—2¼	59—2¼	77—2¼	43—2¼	61—2¼	38—2¼	51—2	56—2¼
Flues, number and diameter, in.	221—3½	231—3½	231—3½	50—5⅜	50—5⅜	182—3½	177—3½	177—3½	167—3½	50—5½	203—3½	202—3½	195—3½	210—3½	195—3½	214—3½	218—3½
Length over tube sheets, ft. and in.	21—0	21—0	21—0	21—6	21—6	21—0	21—6	21—6	21—6	22—0	20—6	21—6	22—0	22—0	22—0	21—0	21—0
Grate area, sq. ft.	108	108	108	88.2	88.2	115	84.4	84.4	84.4	84.3	93.5	88.3	88	102	97.7	100	103
Heating surface, firebox, total sq. ft.	452	516	540	493	515	485	432	432	415	436	422	515	446	401	379	558	540
Heating surface, tubes and flues, sq. ft.	4,981	5,130	5,132	4,700	4,621	4,115	3,812	3,812	3,805	4,171	4,509	4,928	4,471	5,004	4,402	4,656	4,860
Heating surface, total evap., sq. ft.	5,433	5,646	5,672	5,193	5,136	4,600	4,244	4,244	4,220	4,607	4,931	5,443	4,917	5,405	4,781	5,214	5,400
Superheating surface, sq. ft.	2,250	2,420	2,426	1,324	1,324	1,992	1,840	1,840	1,931	1,388	2,112	2,243	2,229	2,444	2,265	2,357	2,403
Comb. evap. and super. surface, sq. ft.	7,683	8,066	8,098	6,517	6,460	6,592	6,084	6,084	6,151	5,995	7,043	7,686	7,146	7,849	7,046	7,571	7,803
Proportions and Ratios																	
Weight on drivers ÷ weight of engine, per cent	63.8	63.5	63.1	64.0	63.0	61.1	60.7	61.1	60.7	58.8	59.0	61.2	61.6	57.9	58.8	57.8	57.4
Weight on drivers ÷ tractive force	4.08	4.12	4.13	4.17	3.66	4.52	4.05	4.10	4.08	3.89	4.12	3.98	3.96	4.08	4.04	4.42	4.31
Weight of engine ÷ comb. h. s.	54.9	53.2	53.3	64.6	64.8	64.7	62.3	62.7	62.2	66.5	59.8	56.5	57.2	60.2	59.7	66.8	57.8
Firebox surface per cent evap. h. s.	8.32	9.15	9.52	9.51	10.03	10.54	10.18	10.18	9.85	9.47	8.56	9.47	8.87	7.42	7.92	10.71	10.0
Firebox surface ÷ grate area	4.18	4.78	5.00	5.59	5.84	4.22	5.12	5.12	4.92	5.16	4.50	5.83	4.96	3.94	3.88	5.58	5.24
Superheat. surface per cent comb. h. s.	29.3	30.0	30.0	20.3	20.5	30.2	30.2	30.2	31.4	23.2	30.0	29.2	31.2	31.1	32.2	31.1	30.8
Tractive force ÷ comb. h. s.	8.59	8.19	8.15	9.92	11.08	8.73	9.33	9.33	9.24	10.05	8.65	8.67	8.92	8.53	8.28	8.62	7.69
Tractive force × dia. drivers ÷ comb. h. s.	627	598	595	763	776	638	681	681	674	733	648	598	625	623	662	655	569
Comb. heat. surface ÷ grate area	71.1	74.7	74.9	73.9	73.2	57.3	72.2	72.2	72.8	71.2	75.3	85.9	81.2	76.9	72.1	75.7	75.8
Notes	b-c-e-k	b-c-d-e-k	b-c-d-e-k	a-d	a-d	a-f-g-k	b-d-e-k	a-d-e-k	a-d-e-k	a-d	b-e-k	a-d-g-k	b-c-d-e-k	b-c-h-k	b-c-h-k	b-c-d-e-g-k	b-c-d-e-k

Key to notes:—a—Boiler diam., inside; b—Boiler diam., outside; c—Combustion chamber; d—Syphon; e—Feedwater heater; f—Limited cutoff; g—Booster or aux. loco.; h—Exhaust steam injector; k—Type E superheater.

Spot Repair Systems Can Be Flexible*

By A. J. Krueger†

The author cites two cases in which, under quite different conditions, reductions of 20 and 35 per cent in labor costs were effected as compared with former less systematic methods

THE progressive or spot system of repairing freight cars is a subject which may be approached from various angles and is a topic worthy of discussion due to the many advantages which it offers under proper conditions and to the fact that there are various ways in which the same results can be accomplished.

The plan, to be successful, must be well defined. It should be well understood by every one involved and a spirit of co-operation within the operating organization must exist.

The contract shop was, no doubt, the original user of the system identified as a progressive or spot method of building cars, and the character of the work in connection with the building of new equipment was one of the features which brought about this system due to the uniformity of the work. Therefore, the railroads themselves do the same thing with the diminishing number of wood cars and the increasing number of steel cars in service which are more uniform in construction and lend themselves readily to a method of this kind.

In the maintenance of all-wood freight cars it is not unusual for cars to be more or less frequently on repair tracks and few, if any, such cars can be given a general repair and then put into service with any assurance that a predetermined definite service life of several years will result with only minor repairs or scheduled intermediate repairs in the interim. However, with the improvement in car design and construction brought about by the co-operation and efforts of car designers, car builders and specialty manufacturers, it has become possible to anticipate general repair dates in advance for various series or classes of equipment and arrange car-repair programs accordingly.

Repairs May Be Scheduled Far in Advance

Take for example the modern freight car in which the center sills seldom need repairs other than that required due to accidents. Draft gears have been improved to the extent that they give considerable service life and many railroads believe that inspections made every two or three years help improve such service life. Steel roofs on cars of a certain design last from 7 to 15 years, or longer, and the all-steel ends, replacing the wood end which was the principal element of repair, requires hardly any repairs. All these bring about a uniformity in the construction of the car which makes it adaptable to a spot or progressive system of repairs and the same conditions can be applied for certain series or certain types of cars as in the case of building new cars. Such conditions manifest themselves to the railroad as to the necessity for establishing a spot or progressive system of repairs to increase output and reduce the cost of doing the work.

There are various ways in which cars might be repaired under a spot or progressive or specialized system of repairing the car as follows:

A—Using double-end tracks with various car spaces for each position moving the cars as required.

B—Using a shop with dead-end tracks, establishing positions for various items of work and moving the cars as required.

C—Using one or more tracks, either dead-end or double-end, assigning men to specialized positions and moving the men and delivering the material to the car, permitting the car to remain at a fixed location until completed.

In the establishment of any spot or progressive system for repairing cars, it is desirable that the element of yard-engine expense should be given serious consideration by the mechanical department, which should make contact with the operating department in the establishment of such system so that all possible economies can be obtained. There are, no doubt, other methods or combinations which will work out advantageously in the repairs to freight cars and it is quite probable that examples of various methods or systems are in operation today on other railroads which are producing satisfactory results. However, any method established should be sufficiently flexible to adjust the output contingent upon the length of track, size of shop and other facilities.

Some mention might be made of the miscellaneous repairs which cars require from time to time and which might be specialized by providing separate locations for changing wheels and repairing door mechanism, etc., and it is my thought that light intermediate repairs of this nature should not be confused with the specialized general repairs to certain series freight car equipment. It would probably be better for such intermediate repairs to be made currently on light-repair tracks as required without specializing the work.

Where the double-end track is employed in the spot or progressive system, it should be, of course, of suitable length not only to provide space for the cars actually undergoing construction, but space should be reserved, dependent upon the output for cars, to be used when some position falls behind and to prevent a tie-up of the track or tracks.

To make the system economically successful, cars should be selected for repairs which are as uniformly in the same state of disrepair as possible and it is quite likely that any series of cars would meet this requirement if they had not had extensive repairs since the last shopping or since having been built.

The question naturally arises relative to the extent to which repairs should be made in so far as replacing material not yet worn out is concerned. If the cars are

*Abstract of a paper presented at a meeting of the Central Railway Club, Buffalo, N. Y., October 8, 1931.

† Mr. Krueger is master car builder of the New York, Chicago & St. Louis.

being repaired with the expectation of securing any definite service life before another shopping, any parts should be renewed while the cars are being given general repairs that will not have sufficient life for the anticipated period between shopping. For example, a steel hopper car requires renewal of side, floor, long hood and cross hood sheets. The hopper sheets are good for one year additional service. At that time the car will again have to be shopped for hopper sheets and considerable work performed at the general shopping will have to be performed again in order to make the application of the hopper sheets. The loss of material life in the old hopper sheets is offset by the duplicate labor costs at the second shopping and from an economical standpoint the hopper sheets with one year life should be renewed at the first shopping. On the other hand if the material in the car has sufficient service life to last for such a period of time that it cannot be economically renewed at the general shopping the material should be permitted to run until an intermediate shopping period.

Proper Renewal of Parts an Important Consideration

Sufficient material should be provided in advance so that no delays will occur because of material shortage. An inspection of a reasonable number of any series of cars will provide the means for making an intelligent estimate of material requirements for the entire series.

Proper material supply is one of the most important items in making the system successful. It is a well known fact in contract shop work in the building of new equipment for railroads that they have at times absolutely refused to start the work on the cars until the material is actually on hand or in sight. This feature alone has been repeatedly overlooked by railroads in the operation of their shops, resulting in expensive operation and loss of output. In forecasting the work to be done on the car when brought into the shop, it does not necessarily mean cutting the car out of service, but can be based not only upon the experience of the supervisors in charge of the series in question, but also by actual inspection of a representative number to know what the material requirements will be to make the repairs desired.

At most locations it has been found convenient to strip the cars at separate locations away from the repair track and in advance of going into the shop, making it possible to reclaim and salvage material in time so that it will be ready for use on the cars when they are repaired.

Systematic Repairs a Real Economy

As an example of savings which can be made through the use of specialized progressive or spot systems of car repairs, it might be interesting to describe the following:

A series of 36-ft. double-sheathed, fishbelly underframe, steel-end box cars were being repaired at several shops. These cars were about 10 years old and were receiving rather extensive repairs. Most of the wood parts and roofs were renewed on nearly all cars. The former practice had been to assign a gang of car repairmen to a car. These men stripped the cars at the point of repairs and then made all necessary repairs. This resulted in a large amount of refuse on the repair tracks to be picked up. The repairs to these cars were concentrated at one point where open-end tracks were available. A stripping track was provided and the cars were stripped at this location. Scrap cars were provided and all refuse was immediately put in the scrap cars. Material to be repaired and used over was sent to repair shop and from there to the proper location on the progressive track. Usable material was sent directly to the proper location on the repair track for reapplication.

On the first position, repairs were made to trucks, draft gears and miscellaneous steel parts. There were three active and three reserve car spaces for this position. On the second position, repairs were made to the frames and floor and three active and three reserve spaces were used. On the third position, sheathing application was made and on the fourth position, lining, belts, rail caps, etc. were applied. The third and fourth positions occupied two active and three reserve spaces. Safety appliances and doors were applied on the fifth position using two active and one reserve space. On the sixth position, permanent scaffolds were erected for the roofers who applied the roofs, running boards and roof platforms on one space. The safety-appliance gang followed the cars through this position for miscellaneous trimming when necessary.

Both plans were operated on the piecework basis of payment for all operations. When the specializing progressive or spot plan was placed in effect, we succeeded in negotiating lower prices for the work. The result was that we saved an average of 20.7 per cent, or about $20 per car in the labor cost for repairing the cars, while the workmen's piecework earnings did not decrease. The savings mentioned were for direct car-repair labor only and does not include strippers, air-brake men, painters, supplymen and other miscellaneous workmen involved.

A second track was available and occasionally was used with a duplicate force. Cars were set on the stripping track and on the lead to the first position once each day by a yard engine. The cars were moved from spot to spot by a tractor. This system had the disadvantage of requiring switching movements from both ends of the repair yard.

A series of 55-ton composite twin hoppers (the floor and sides were wood) about 10 years old and requiring 100 per cent renewal of floor and side plank, as well as all bottom sheets and hopper doors, had been repaired at various points by single gangs of car repairmen in much the same manner as the box cars.

The repairs to these cars were concentrated at a shop having four dead-end tracks each holding five cars. The cars were stripped on a stripping track located some distance from the repair tracks and set in groups to fill the tracks. In this case the men were moved. The first operation was performed by the truck gang who raised all cars and set them on horses. These men then started at the headend of the first track and repaired the trucks and draft gears going down on one track and back the next track. The next operation was performed by a first fitting gang who were in turn followed by the first riveting gang. The second fitting and riveting gangs followed; in turn came the side-plank gang and the floor gang. The side-plank gang handled all of the safety-appliance work and the floor gang adjusted the hopper-door mechanism. The truck gang followed through once more and placed the cars on the trucks. Once the gangs were in movement no delay was experienced throughout the entire repair period. These men were also on a piecework basis and we were able to negotiate new prices so that we were able to save 35.1 per cent or $59 per car on direct labor costs, including stripping, but not including painters, air-brake men, supplymen or other miscellaneous workmen.

Under this plan it was necessary for the yard engine to fill up the stripping and repair tracks when cars were required as it was not possible to have this work per-

formed daily at a set time as was the case with the box cars. The yard engine moved the cars to a sandblast and paint track and again out of the yard after being painted.

In my opinion a system of this type, properly operated, will produce a net tangible saving coupled with the fact that such system of repairing cars ties itself closely with the periodical general repairs and while it is certainly not desired to recommend wasteful uses of material, it is our opinion and experience that the combination of periodical repairs with some form of spot or progressive system will keep cars in better condition at a lower cost.

Cast-Steel Foundations For Railroad Equipment

(Continued from page 577)

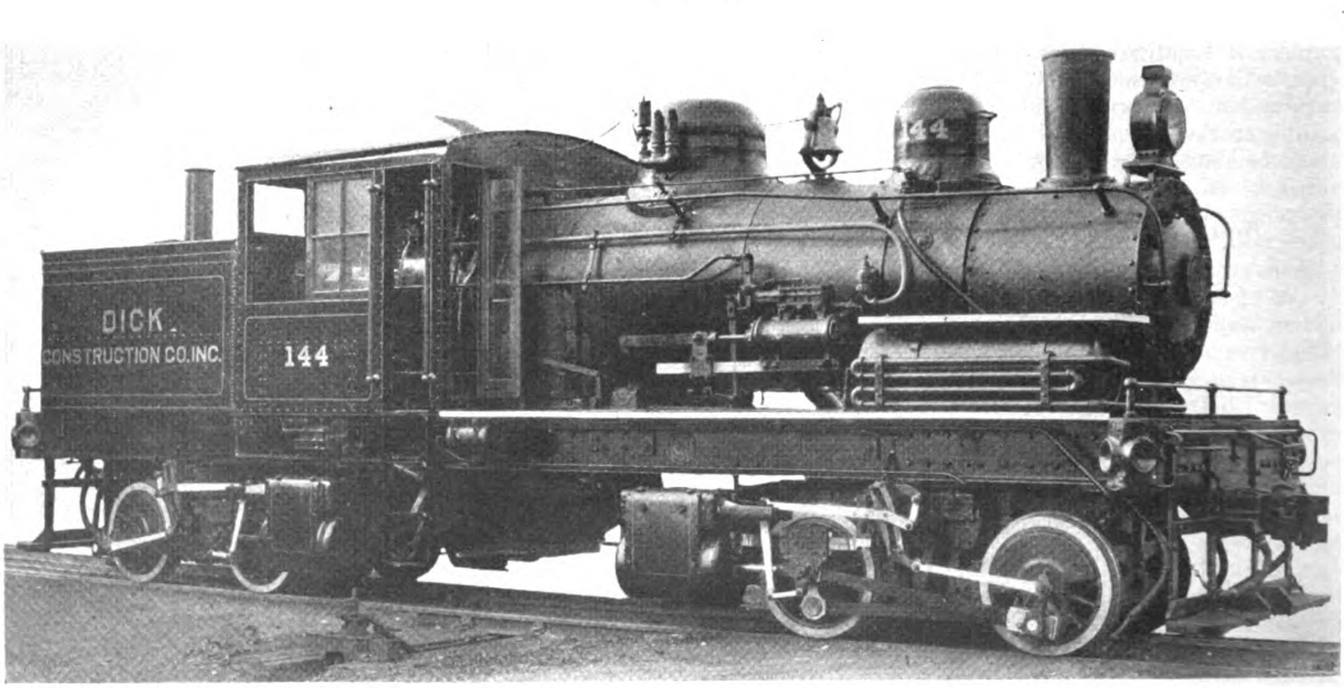
mobiles to be loaded in each car. The door frame and end of the car, including the end sill, have been made in a single steel casting. The door-hinge butts are an integral part of this cast frame and the doors close into recesses which insure tightness when locked.

The examples which have been given here of the use of large steel castings in freight cars show the possibilities of this type of construction. It cannot be too strongly emphasized that the design of steel castings is a highly specialized profession. Too much care cannot be given to the design of the cast structure. While a skilled foundryman can make a poorly designed casting, the place to start to make the best job is on the drawing board, where a pencil and eraser can easily correct defects and make improvements. The success which has attended the use of these large steel castings and the great progress made in this field are due, in great measure, to the attention given by the manufacturers to the engineering phases of their products.

Those Early Sleeping Cars.—A graphic description of one of the very early sleeping cars is found in a railway manual published in 1865. The writer said: "Within a year I have seen the oldest and the newest sleeping coaches, the remote past and the near future of railway travel at night. What a contrast the two present! The early sleeping car was low and narrow, and dark and stuffy. It wobbled and creaked and moved in all directions like a ship's compass. It had little windows that you could look out of only by bending double, and a narrow passage walled in by iron rods, one reaching to the roof from the back of every seat. On these poles the upper berths were hitched till they were ready for bedtime. The lower berths were narrow and so short that you had to lie in one like a half-opened pocket-knife with your knees in the air and the bed clothes pushed up like a tent. You did not need to be pious in order to thank Heaven when you got out of that car.

Speaking of Locomotives.—To look at locomotive is pretty from locomotive came the locomotive shed. It is fitted with many parts. First will start from the front portion. (1) Fitted with Chimney, the same is set on smoke box. The smoke box is set on the frame and the frame is set on wheels. Smoke box is extended which is called a boiler. And there is a boiler face plate which is fitted with whistle to avoid accidents and instruct public that train to start. Injection to inject water from tender to boiler fitted with vacuum brakes to stop a train running, & fitted with gauge column to show how much water in the boiler & fitted with hand brake to use when singine has no steam and fitted with a tender which carried the water. Top of the tender is the cool food for the Engine. The Engine is fitted with certain number of wheels & rods are fitted by the sides which are called side rods, other rods are connected from one end to the other. The biggest part on is called the big end. The small ends are called the little ends. The little end is connected to the portion which is held by the motion bars & extend to a cylinder contains a head & a rod fitted with steam chest contains valves & inlets & chest connected with steam pipes. Extends inwardly in the boiler with a throttle valve which is covered with big cap called dome the same leads on to the face plate fitted with a guide & regulator, that regulates the Engine to run. These fitted makes Engine look pretty. There is also nice cover made for the driver and fireman to be protected from sun, moon, rain & storm. So the parts of the locomotive and working of the same is a great pleasure to the driver, fireman, cleaner. Cleanliness is next to Godliness. To have a clean Engine makes the Engine pretty and the work a pleasure.—From a pamphlet on the operation of the steam locomotive for the guidance of Indian engineers, reprinted in the Railway Gazette, (London).

* * *



"Duplex" locomotive built by the Vulcan Iron Works, Wilkes-Barre, Pa.

Diameter of drivers, 33 in.; cylinders (four), diameter and stroke, 13 in. by 16 in.; boiler pressure, 200 lb.; tractive force, 30,000 lb. Weight in working order, 110,000 lb.

EDITORIALS

The 1930 Index

An index of the articles appearing in the 1930 issues of the *Railway Mechanical Engineer* will be printed and available for distribution shortly after the first of the year. It is available to all of our subscribers who wish to have it. It adds materially to the permanent value of the contents of the year's issues by making it easy to locate material on any subject after one's recollection of specific articles has become considerably dimmed. If you have been receiving a copy of the index in past years, you need take no further action; you will automatically receive a copy of this year's index. If you have not been receiving the index, but find that you would like to have it in the future, drop us a line and your name will be placed on the list of subscribers who are regularly receiving the index each year.

Cleanliness And Safety

An Interstate Commerce Commission inspector, speaking recently before a group of railroad men, made the statement that one of the things he had noticed on a certain road was the increasing tendency to allow the locomotives to run in a dirty condition. Dirt, grease and grime on locomotive parts are indefensible from several standpoints: They detract from the appearance of the locomotive, make the work of repairing and adjusting parts a much more difficult and disagreeable job, and, last and most important, dirty locomotive parts are a potential source of danger. Defective parts that are worn too much to be safely serviceable and cracked parts that are a positive danger cannot be discovered by an engineman or inspector if they are covered with dirt and grime.

There was a time when to keep a locomotive clean was a matter of pride. Possibly that day is gone but when locomotives are so dirty that it is next to impossible properly to inspect them in order to insure their safe operation it is another matter. There is no excuse today for a dirty locomotive; modern locomotive cleaning systems are so efficient in their functioning and so economical to operate that it would seem a matter of absolute necessity for a railroad to assure itself of the safety which is provided by the simple matter of cleanliness.

The Price Is Too Great

Considering the number of locomotives in interstate commerce in the United States, locomotive boiler explosions are of very infrequent occurrence. Last year (1930) the number of crown-sheet failures reported by the Bureau of Locomotive Inspection was 11; in 1929 the number was 17, and in 1928 it was 22. Because of the almost inevitable toll of deaths and the great destruction of property with which they are accompanied, however, crown-sheet failures stand in a class by themselves in relation to all other accidents caused by failures of locomotives and their appurtenances. There never will be justification for an attitude of complacence toward them. No goal short of complete elimination of such accidents can be entertained and, should that goal be reached, the destructive potentialities inherent in the locomotive boiler under pressure are ready to break forth the moment complacence causes a relaxing of discipline in the shops, in the enginehouse or on the road.

The report of an investigation of a recent boiler explosion clearly illustrates the necessity for observing all of the precautions which have been suggested and recommended in the annual reports of the Bureau of Locomotive Inspection, if such accidents are to be prevented. In the case in question the omission of the metal washers over the water-glass gaskets resulted in the complete obstruction of the opening at the top of the glass. This, it would appear, was the result of an inexcusable bit of carelessness on the part of an enginehouse or shop employee—a kind of carelessness which should not be tolerated, but which, unfortunately, will probably occur occasionally in spite of all of the precautions which alert supervision can take. Had the locomotive in question been provided with an additional water glass on the fireman's side of the back head, the probability of this accident occurring would have been reduced by much more than one-half. The cost of this single accident saved would probably have more than sufficed for providing all of the locomotives on the railroad with this additional safeguard and four experienced railroad men would have been saved to the service—and to their families.

Periodical Freight-Car Repairs

One of the high spots in the history of locomotive maintenance during the past 10 years was the inauguration of the practice of making periodical inspections and as a result of such inspections making the repairs and renewals of parts necessary to keep the locomotive in service until the next inspection date without the liability of failures in service. The question arises as to why the same system would not be highly desirable in connection with freight cars.

The experience of several railroads in the eastern part of the country has indicated not only that such a system is desirable but that it offers opportunities to improve materially the standard of freight car maintenance as well as to lower the cost. The practice of making a thorough inspection of all of the parts of the car at some stated period—say once each 12 months—cuts down the liability that a car will appear on a repair track, either on the home or a foreign line, as many times during a year as would ordinarily be the case. This is due to the fact that air brakes will be cleaned,

for example, at the same time that journal boxes are repacked to conform with A.R.A. rules, whereas it is the exception rather than the rule that both of these operations are performed at the same time under the present system, which is no system at all.

As running repairs are made at present, it is the practice to repair or renew only those parts that may have been reported defective or inoperative by the inspector. Why, for example, should one brake-beam hanger or hanger pin on a car be renewed and the car sent on its way when there is a possibility that other similar parts on the same car may be in such condition as to require their renewal at an early date, if not at present. It is a simple matter for a competent inspector to see and report defective parts and it would involve but little more work on the inspector's part to discover those parts which are in such condition that they will render but little more service before failure occurs.

A periodical inspection and more or less general repair by railroad of its own cars while on its own line would materially reduce the number of times the cars would appear on foreign repair tracks in the course of a year and, as a consequence, would enable a road to exercise closer control over freight-car repair costs by the elimination of many practices which are now a part of the necessary evil of having cars repaired on foreign lines. The very fact that from 60 to 80 per cent of the money spent by the average railroad for freight-car repairs is expended for running repairs indicates that here should be the broadest field of opportunity for making improvements. There are so many advantages to be gained by inaugurating a system of periodical repairs for freight cars that it seems worth while for mechanical officers to devote a great deal of attention to the subject at this time.

The Economy of Modern Locomotives

The definition of the term "modern locomotive" is subject to frequent revision. The qualifications which characterized the modern locomotive of 1920 are not those which characterize the modern locomotive of the present day. There is reason to believe that five years hence, further revisions in the definition may be necessary. Ten years ago the capacity of the modern freight locomotive was still measured by its maximum tractive force. It was built to haul tonnage. The time required to move its tonnage over the division, however, had not yet become a matter of general concern. Today the capacity of the modern freight locomotive is measured in terms of horsepower. It must be able to handle a heavy train and must move it over the road at relatively high speed—in some cases, indeed, at speeds approaching those of passenger trains. Its ability to meet these conditions is the result of increased boiler capacity. This increased capacity has been effected in part by a reproportioning of the boiler itself and in part by building into it the best that are available in the way of capacity- and economy-increasing devices.

In an article elsewhere in this issue is set forth specifically what the high horsepower output of the modern freight locomotive means both in the way of tonnage and speed capacity and in fuel economy in comparison with a locomotive of similar coupled wheel arrangement which would have met the specifications of a modern locomotive even less than ten years ago. The new locomotive, the results of the tests of which are set forth in the article, is of the 2-10-4 type, with a weight on drivers of 348,200 lb., has a total evaporating heating surface of over 6,000 sq. ft., a superheating surface of over 2,500 sq. ft., and 121.5 sq. ft. of grate area. This locomotive handled 15 per cent more tonnage in 9 per cent less time over the same division and with 17 per cent less fuel per 1,000 gross ton-miles than a 2-10-2 type locomotive with about 8 per cent less weight on drivers, but with about 17 per cent less evaporating heating surface, 45 per cent less superheating surface, and 27 per cent less grate area.

This comparison indicates what changes have been wrought in the basic proportions of locomotives within the past few years and what they mean in actual performance. Other instances are available where equally satisfactory improvements have been made by the substitution of modern locomotives for locomotives of similar driving-wheel arrangement less than ten years old —improvements which have been effected under a wide variety of operating conditions.

Obsolescence is not a matter of age or physical condition, but a matter of the advancement in the art of locomotive design and construction. There are few freight locomotives ten years old or older which are not today obsolete. Their retention in service, no doubt, is justified in specific cases, but the superiority of the modern locomotive has so frequently been demonstrated within the past three or four years that the burden of proof in such cases clearly belongs on the old locomotives. This approach to the motive power problem will avoid expensive mistakes.

Modern Power Plants Help Operation

Unsuspected strong and weak points in railway operation are showing up as a result of the critical analysis now being made on many roads in the interests of economy. Fuel consumption per 1,000 freight ton-miles and per passenger car-mile has continued to decline to hitherto unexplored low records despite the curtailment and, in some instances, the outright abolition of a fuel economy organization that assumed large proportions during the late era of expansion. This may be attributed in part to the persistence of the fuel economy idea, so thoroughly has it been drilled into all branches of the service during the last 20 years. More especially does the continuing improvement in fuel performance reflect the acquisition of modern power plants on wheels, superseding less efficient units that have virtually been retired from service since the decline in traffic has enabled the roads to operate exclusively with efficient motive power. Contrasted with the fuel economies thus effected, the present situation serves to emphasize the weakness in respect to a large number of stationary power plants at railway shops and terminals.

This matter has been neglected because, in many instances, railway officers have too little appreciation of the actual qualities of fuel consumed in these stationary plants, or the large demands for steam required of the average terminal power plant. A consumption of several hundred horsepower is not exceptional for a 30-stall enginehouse with small shop extension, exclusive of the added heating load in winter and steam for steaming up locomotives. The operation of a steam-driven compressor, of boiler feed, the washout and filling pumps for locomotives, and other auxiliaries, not to mention the steam hammer and other shop uses for steam, all con-

tribute to this load. Now it may be argued that a stationary power plant output of about 400 horsepower is as nothing compared to the output of a super-power locomotive hauling a tonnage train. But, let us consider this as an all-the-year proposition. The locomotive is tied up for repairs on an average about 10 per cent of this time. While not undergoing repairs, or stored, the average time between terminals, during which the locomotive is consuming fuel for the production of ton-miles or passenger car-miles varies according to the practice on various roads. Probably 33 per cent would be a high average for all locomotives of the type under consideration. Then these locomotives are by no means operated to develop their full boiler capacity for the entire time that they are in service between terminals.

After all is said and done, it will be found that the average stationary power plant at even a moderately small terminal will produce more horsepower, measured in pounds of steam, and consume more fuel for the entire year than the average super-power locomotive. Does not the efficient stationary power plant, therefore, deserve consideration in the interests of economy, as well as modern motive power units? Modern motive power has the advantage of increasing the tonnage capacity of an operating division, but modern stationary power plants, with ample reserve steaming capacity, also favorably affect operation by increasing the availability of locomotives when steamed up and held ready for service with steam generated in efficient stationary boiler equipment.

On many roads, the stationary power plant has been regarded as more or less of a side issue. Anything that would produce the steam would answer the purpose. The glare of a statistical searchlight turned upon fuel consumption per 1,000 freight ton-miles or per passenger car-mile left the power-plant coal pile in the shadow. Given the same intelligent consideration that has been bestowed upon the power plant on wheels, a proportionate expenditure upon railway stationary power plants will produce fuel economies as lasting and proportionately as substantial as already accomplished in road service.

Merchandizing Transportation

War times tend to stimulate mechanical developments; periods of business depression tend to retard them. Witness the stimulus given to air craft, oil and gas engines and radio during the last war, a stimulus which continued until 1930. Similar progress occurred with respect to railroad power and rolling stock. The years from 1918 to 1930 were years during which engineers in both the railroad and railway-supply industries saw many of their dreams and ideas become actualities.

It has been because of this remarkable progress made in mechanical equipment that engineering has been credited with being one of the major factors in bringing about the present depression in business. Engineers are accused of developing and producing new tools and mechanical facilities for mankind at too fast a pace to be absorbed. Mechanical developments, it is contended, moved too rapidly for our present methods of distribution.

Of course, the truth of such statements is open to argument, but the fact is that this depression is focusing attention on the problems of distribution, the most important phase of which is merchandising.

A large number of railroads, appreciating the changes which have come about with respect to merchandising railroad transportation, have enlisted all employees as traffic solicitors. Augmenting the efforts of the railroad sales force in this manner has accomplished worth-while results. Railroad men are becoming sales conscious. However, all the salesmanship ability, from the most expert down to the rankest amateur, natural or acquired, will not get far unless there is something to sell that is better than the other fellow's. The mechanical department has the job of procuring equipment which will convince the shipper and traveller that railroad transport facilities and service are superior to anything else available.

The job of merchandising railroad transportation has been brought into the offices, drawing rooms and shops of the mechanical department more vividly during the past two years than perhaps at any previous time in railroad history. It has been necessary to procure power which would haul increased tonnage at faster sustained speeds, and to have cars and locomotives that would possess maximum availability and long service life, with low maintenance expense in order to meet the onslaughts of continually reducing rates and lower earnings. Competition from other forms of transportation and from other railroads has required considerable time and effort on the part of the mechanical department to produce improved conveniences and facilities for traveller and shipper. It is generally conceded that much of the kind and character of service rendered by the railroads during the prosperous years preceding 1930 will be subject to a variety of modifications from now on.

Just what these changes will be, is still problematical. However, the past two years have seen constructive progress made toward the elimination of dust and foul air in passenger cars and the introduction of freight equipment specifically designed to recover traffic lost to the highways.

T. C. Powell, then president of Chicago & Eastern Illinois, gave an illuminating address on this subject at the 1930 convention of the Car Department Officers' Association, in which he strongly recommended that real consideration be given to shippers' requirements when designing freight cars. In his address, an abstract of which appeared in the September, 1930, issue, he contended that many of our present freight cars were real stumbling blocks in the way of securing freight traffic.

All things considered, there is good reason to believe that a large part of the problem of merchandising railroad transportation will fall to the mechanical department. Cars and locomotive service must be provided that traffic solicitors can sell. Equipment must be furnished that will get the business.

NEW BOOKS

Der Warmeubergang im Luftkompressor *(Heat Transfer in Air Compressors). By Dr. Karl Kollmann Published by Vereine Deutsch Ingenieur, Berlin, Germany. Illustrated. Price, cloth cover, 5 reich marks.*

A conspicuous gap in the information about machines with lower working temperatures, such as air compressors, is filled in the discussion of the results of a detailed calorimetric research on a two-stage air compressor which is presented in this book by Dr. Kollmann. This investigation embraced a speed range of between 60 and 160 r.p.m., a back-pressure range between 14 and 250 lb. per sq. in. above atmospheric pressure, and mean cooling water temperatures from 90 to 120 deg. F.

THE READER'S PAGE

Fitting Hunt-Spiller Bushings—A Question

To the Editor:

In fitting Hunt-Spiller gun-iron bushings on 2-10-2 type middle connections, side rods and main rods, and on the middle connection on 4-8-2 type passenger engines with floating bushings, if the bushings are bored straight and pressed in they close up by about 1/32 in. or less and have to be bored out. I found that, by boring the 2-10-2 type locomotive bushings with a .015-in. taper, they were straight after pressing them in. The middle connections are made .028 in. larger outside and .015 in. taper inside. Main rods are made .020 in. outside and .015 in. taper inside. These bushings are pressed in with a pressure of approximately 30 and 35 tons. Mountain type middle connections are made .020 in. outside and .010 in. taper inside. Boring these bushings with a taper on the inside saves time and eliminates boring out after they are pressed in.

Gun-iron bushings on the middle connections of 2-10-2 type engines wear thin on the flange side and have to be renewed after they wear down to ½ in. or less. They are ⅞ in. thick when finished, 13½ in. outside, 12 in. inside, 6⅛ in. long, and 5¼ in. under the flange. The main-rod bushing does not wear the flange, but becomes loose at times.

I would like to know the practice other railroads follow in fitting these bushings on locomotives of these two types.

W. E. Howard.

Answers to Air-Brake Questions Disputed

To the Editor:

I have been reading with considerable interest the questions and answers on air brakes in the *Railway Mechanical Engineer*, which, if I understand correctly, are compiled by an eastern road.

In the September, 1931, issue there are two questions, the answers to which, in my opinion, are not entirely correct. One of the questions with its answer is as follows: Name some defects in a brake valve which may prevent brake application on a 5-lb. brake-pipe reduction. Answer: Preliminary exhaust port restricted, resulting in slow rate of brake-pipe reduction; leaking automatic or brake-valve rotaries; leaking bottom gasket independent brake valve, U-pipe removed.

In this answer I take exception to that part stating "U-pipe removed," as in my opinion removal of the U-pipe would have no effect on the application of the automatic brake (No. 6 ET equipment).

The question reads: What would be the result if the U-pipe were removed or leaking? Answer: With the independent brake valve in running position it would be impossible to make a service application.

Regarding the answer to this question, I contend that with the U-pipe removed a service application would not be effected with either brake valve. My understanding is that the U-pipe is the pipe which extends from the independent to the automatic brake valve and is a continuation of the release pipe, its purpose being to incorporate the holding feature. If the U-pipe is removed or leaking, it would merely eliminate this holding feature, the operation of the brake not being affected in any other way.

The release pipe begins at the exhaust port in the equalizing-valve seat of the distributing valve and terminates in the rotary valve of the automatic-brake valve. This pipe can be cut off at three different places: at either brake valve, and at the equalizing valve of the distributing valve. When the equalizing valve of the distributing valve is moved by a brake-pipe reduction, the release pipe is cut off and no air will enter the release pipe at that time. This applies to the U-pipe, as it is a part of the release pipe. If the distributing valve did not "blank" this pipe, it would be impossible to operate the brakes on a second engine while double-heading.

I presume the questions in the September issue were on No. 4 Westinghouse equipment.

W. D. Herndon.

All-Year Oil With 50 to 55 Viscosity

To the Editor:

It is noticed that most of the articles and letters from readers published in the *Railway Mechanical Engineer* point out that more trouble is experienced with hot journals in the winter than in the summer. It is my experience that the exact opposite is true; that is, that more trouble is had with hot journals in summer months. The reason advanced is the use of winter-grade and very light viscosity oil too late in the summer months. I am identified with a railroad which operates in the northern part of the United States, where very low temperatures are encountered. Hot journals have been greatly minimized by using clean waste and a grade of oil with viscosity ranging from 50 to 55 at 210 deg. F. the year round.

Again it is noted in many of these articles that the grade of oil is usually stressed and that but little is said about the waste. It is equally important that a good grade new or renovated waste be used and that the journal boxes be kept tight to prevent dirt, water and other foreign matter from getting into the packing. It is necessary that the boxes and contained parts receive proper attention to get satisfactory results. Otherwise congealing of the oil during zero weather with resultant hot-box trouble cannot be avoided. It should be interesting, as well as instructive, to run a series of tests with waste of different mixtures to ascertain which mixture will hold the oil in suspension the longest. There are grades and mixtures of waste that have a wide variety of ability to feed oil to the journal and hold it in suspension in the journal box.

As evidence of winter and summer performances on this road, with year-round oil having a viscosity range of 50-55 at 210 deg. F., records show that an average of 325,000 miles per hot box was attained in the severe winter months. During July and August, under careful supervision, this average decreased to 137,000 miles, the trouble in the latter months being due largely to cars of foreign ownership. Frequently the packing has been removed from a box on a foreign car that has

run hot and the oil extracted. It is usually found to be very light, not a sufficient amount of oil being held in suspension in the waste to produce proper lubrication. Hence, because of the dry condition of the waste, a potential waste grab is in evidence.

It is my opinion, based on actual observations, that the exceptionally large number of waste grabs detected during the summer can be ascribed to the operation of cars with a low-viscosity oil applied during the winter. In such circumstances it will usually be observed that the light oil has settled largely to the well of the box, allowing the waste on top to become dry and fluffy, inviting waste grabs and thus preventing proper lubrication.

It is agreed that where cars get into territories having extremely low temperatures ranging from 50 to 75 deg. below zero, as stated by "An Oil Man," in the September, 1931, issue, a cut-back oil could be used advantageously with the understanding that only the best grade obtainable should be purchased for this purpose and then used only in moderation. The opinion, however, is still held that the viscosity should never be below 50 or 55 at 210 deg. F., with a minus zero pour point. It is not believed that an oil with a pour point minus zero 50 to 75 is necessary at any time.

It may be of interest to state that on this railroad the same quality of oil is used in both freight and passenger equipment. Seldom has a passenger train been delayed because of a hot journal and, when such trouble has developed, it was usually with a passenger or milk car of other ownership.

The remarks made in the foregoing paragraphs are based on experience gained from a two-year test conducted with year-round oil. The writer of this letter does not profess to be an authority on lubrication, but, like many a railroad man interested in the subject, is striving to do something beneficial and will welcome constructive criticism.

MASTER CAR BUILDER.

Counterbalancing Locomotives

TO THE EDITOR:

In the July, 1931, issue of the *Railway Mechanical Engineer* there is mentioned a new method of computing the counterbalance of locomotives, the results of which were stated to be very satisfactory, the engines so balanced being improved in riding qualities. I should like to know this method.

I should also like to know the answers to the following questions:

1—What percentage of the reciprocating weights are balanced?

2—Is the percentage varied for different diameters of drivers, or is the piston speed used as a limiting factor in the speed of the reciprocating parts?

3—Can the percentage be increased for three-cylinder engines?

4—By how much (roughly) can the hammer blow be reduced by using three-cylinder engines?

5—What increase (percentage or otherwise) of axle load due to dynamic augment would be considered fair?

6—Has the lead-pocket type of counterbalance gone out of favor and what were its disadvantages?

7—What, roughly, would be the weight of reciprocating parts for one side of a modern box-type locomotive?

8—With heavy power, is it sometimes necessary to adopt a larger wheel to obtain satisfactory counterbalance?

9—On heavy power does special provision have to be made on the leading truck for the "elbowing" motion? Is the four-wheel engine truck superior to the two-wheel in this respect?

10—Does the tandem rod drive involve placing a reciprocating balance weight in the following pair of drivers, and does the adoption reduce the hammer blow and make longer two-cylinder units economically practicable (apart from bearing pressures)?

K. F. GREEN,
North Fremantle, West Australia.

[Mr. Green refers to the report of the A.R.A. Committee on Locomotive Design and Construction an abstract of which was published in the July, 1931, issue, page 352. In that report, the sub-committee on counterbalancing of locomotives referred to its 1930 report which included a paper on crossbalancing. An abstract of this paper appeared in the August, 1930, issue of the *Railway Mechanical Engineer*, page 448. —EDITOR.]

A Prophecy, A Promise or a Threat?

TO THE EDITOR:

Occasionally the *Railway Mechanical Engineer* raises its lily-white hands in holy horror and proceeds in its editorial columns to politely rake some old established mechanical department practices over the coals. That was my reaction after reading your editorial in the November, 1931, issue on "Expensive Economies."

This shop manufactures replacement parts for some locomotive appliances and does a fairly good job, even if the materials are not the same nor workmanship as fine. True, we do not keep as elaborate a system of books to show our costs as do the manufacturers. Our overhead, etc., are absorbed elsewhere. But we do know our labor and material costs. Shop manufacturing is a big help toward solving the problem of continuity of shop labor. Forces and shop equipment can be used to manufacture parts on stores-department orders when there are no locomotives going through the shop.

Right now, when budgets have been cut to the bone, labor forces reduced to the minimum, and we are robbing cars, as well as locomotives, to keep what we have that is in good condition on the road, because the storehouse in short, we have some real practical problems to solve in which theoretical premises are not much help.

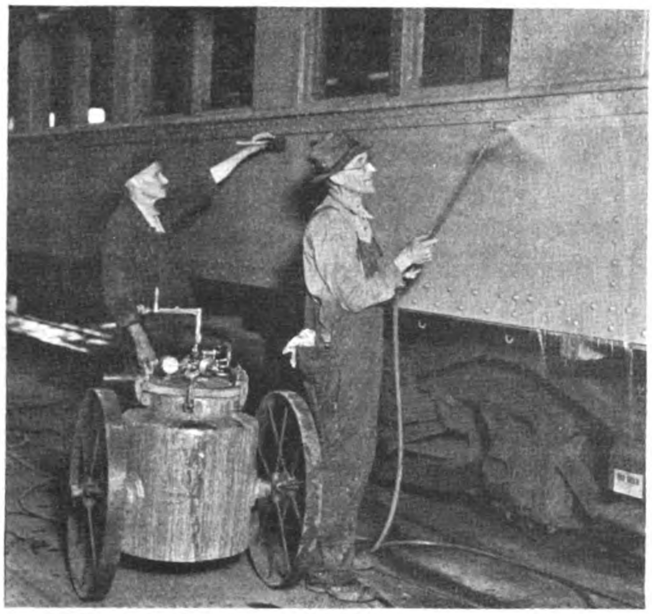
The Egyptian task masters forced the Israelites to make bricks without straw. It is my understanding that the period of depression at that time lasted seven years and straw (like locomotive parts are now) was hard to get. However, Bible commentaries inform us that seven years of famine in Egypt was an event which happened about every fourteen years because of the eccentric behavior of the River Nile. To the Ancient Egyptians, the Nile was an important factor in their economic life. It furnished not only fertile soil to the fields, but also transportation.

This depression has lasted two years. Maybe there are five more to go. Thus far the Interstate Commerce Commission, our state regulatory bodies and others, including certain senators from the middle west, are still hardening their hearts. Unless they get over their stubbornness and see the light, we can expect the "Nile" of the United States (I don't mean the Mississippi or the Warrior rivers, but the railroads) to be as eccentric as the old Nile of Egypt. We will continue to do the best we can to keep cars and locomotives on the rails, even if it means manufacturing a lot of necessary parts in the old shop.

A READER.

With the

Car Foremen and Inspectors



Thirty-gallon pressure feed tank and equipment used in spray-washing cars

Spray Washing Of Passenger Cars

PASSENGER-TRAIN cars received at the back-shop for general repairs must be thoroughly washed inside and out to provide clean surfaces, especially when repainting operations are involved. Until April, 1931, the hand method had always been employed in washing cars at the Milwaukee (Wis.) shops of the Chicago, Milwaukee, St. Paul & Pacific, but, since that time, the spray method has been used with highly satisfactory results, including a saving of 12.23 man-hours, or $6.97, per car cleaned. The following DeVilbiss equipment was purchased for spray washing operations: Two 30-gal. pressure feed tanks, mounted on wheels; four washing guns; four special material-spray guns; and miscellaneous 3/8-in. and 1/2-in. air and fluid hose in 50- to 100-ft. lengths, all installed at a cost of slightly over $800.

Former Hand Washing Methods

Under the hand washing method, the washing force was divided into inside and outside gangs, and these two large gangs were split into smaller gangs of two, four or any number of men that may have been required to wash a car within a given time. Each washer would work more or less independently of the others in the gang; that is, he cleaned only his proportion of a car.

The operation consisted of each washer filling a small bucket full of soap (or acid) and water from the supply barrels located on the wash tracks. He then heated the liquid by forcing steam into it. The man then applied the liquid on the car with a brush or sponge, scrubbed the area and then rinsed it off with a sponge. Each bucket full of liquid would wash only a small area, so constant refilling was necessary.

The slowness of the operation was due to several factors. Constantly refilling the buckets consumed much time, which was lost motion. The application of the cleaning liquid, the scrubbing of the car and the rinsing off, done in each case by hand with a brush or sponge, permitted only small areas to be washed at a time, and it was tiresome work. The entire operation was performed with crude hand tools, it being merely drudgery and offering no incentive for speed or good workmanship. The work was attractive to only the lowest class of unskilled labor.

Spray Washing Method

In April, 1931, an experiment was started on washing cars by the spray method. Two gangs were organized and each gang was equipped with one spray outfit. The men of each gang work together to clean the entire outside or the entire inside of a car. The present or-

Average Cost of Washing Passenger-Train Cars by Spray Method Compared with Former Hand Method*

Class of cars handled	No. of cars washed		Former hand method performance time, man-hours		Present spray method performance time		
	Inside	Outside	Inside	Outside	Date	No. of sprayers	Man-hours spent
Express—wood	7	8	140	144	May 11	4	32
Express—steel	5	5	152	120	May 12	4	32
Express—s.u.f.	1	1	20	18	May 13	4	32
Mail & express—steel	..	2	...	48	May 14	4	32
Express refrigerator—s.u.f.	1	2	6	20	May 18	6	48
Passenger & express—wood	1	1	20	18	May 19	6	48
Passenger & express—steel	1	1	32	24	May 20	6	48
Coach—steel	..	1	...	24	May 21	6	48
Diner—steel	..	2	...	48	May 25	6	48
Sleeper—steel	..	5	...	120	May 26	6	48
Total	16	28	370	584			416
Grand total	44 jobs		954 man-hours				416 man-hours

Comparative Data

Item	Former hand method	Present spray method
Average man-hours spent per job	21.68	9.45
Man-hour saving made per job	....	12.23
Cost per man-hour	$0.57	$0.57
Average cost per car cleaned	$12.36	$5.39
Cost saving made per job	....	$6.97

* Based on cars washed by spray during the experimental period, May 11 to 26, 1931, incl.

Spray washing the interior of a passenger coach

ganization consists of two men in the outside washing gang and three men in the inside washing gang. At present, each gang washes two cars per day.

The operation consists of the gang filling a portable 30-gal. feed tank with a hot chemical solution, and by means of compressed air it is sprayed on the car from a hose and nozzle. Another hose is connected onto the water line and used to rinse off the car. For exterior car washing, one man handles the solution spray and the other handles the water hose. Both washers scrub the car to loosen up the dirt. For interior washing, the method employed is the same except that a third man is utilized for scrubbing. This extra man is necessary to properly balance the inside work with the outside work. Interior washing is a larger job than outside washing, due to the greater area to be cleaned, the woodwork and light colors, and the need for exercising greater care to obtain a clean job.

The speed of the operation is due to several factors. The large capacity of the solution tank and the feeding of the liquid through a hose to the car permits continuous productive work. The application of the solution and the rinsing is done by hose; the scrubbing by hand. Thus the hand work is cut from three operations to one. This permits large areas to be easily washed at a time. The entire operation is designed to afford easy, interesting work. Even the hand scrubbing is minimized by making the cleaning solution "eat" the dirt.

The washing problem is to obtain clean surfaces at a fast rate with a minimum amount of hand work. Experiments and experience have furnished several basic facts. Cars must be scrubbed to loosen up the dirt. The cleaning compound used must be one that will not harm the paint and varnish but will "eat" the dirt so as to minimize the scrubbing. Cleaning conditions vary with the individual cars so that no single mixture of a cleaning compound will meet all requirements. The best results are obtained when the cleaning solutions and the rinsing water are applied to the car hot. Force (pressure) is desirable as the final rinsing step but the mere application of cleaning solutions or water by high pressure will not clean a car for painting. Speed in washing cars can only be obtained by substituting machine methods for hand methods. The procedure to be followed in washing cars is practically the same as that employed in washing one's hands or clothes.

The steps to be followed in washing the exterior of a car to obtain the best results are: Spray the cleaning solution over a large area; scrub the moist area; again spray the cleaning solution on the area; rinse off with warm water (water at city pressure); rinse off with warm water (water at shop air-line pressure).

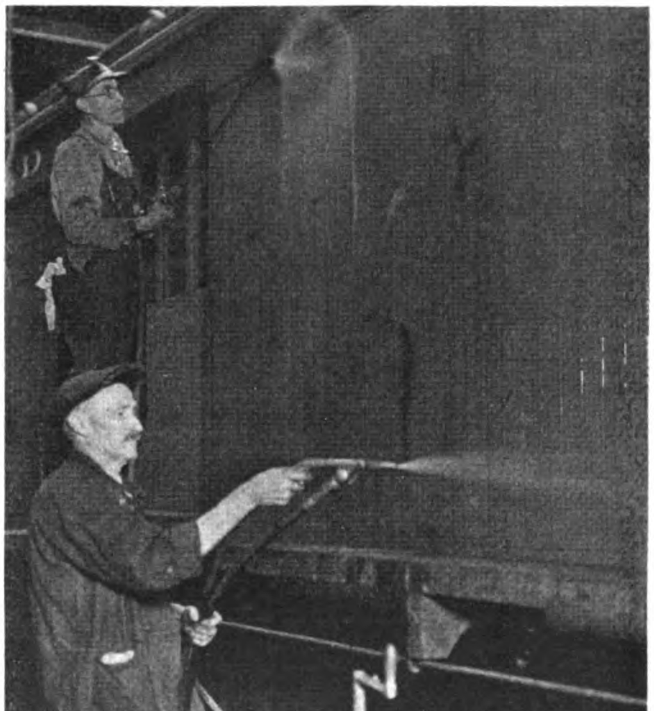
The cars washed by spray are as clean as those washed by hand and are rinsed off better. On steel cars where the rivets are exceptionally dirty, being heavily caked with dirt, a strong solution that loosens this dirt is applied over the rivets in advance of the regular spray washing.

Savings by the Spray Method

When the washing of cars by the spray method was first started, one gang was employed, then a second gang was started, and in May, the third gang started operation. The sprayers were recruited from the washing force.

The original force consisted of 19 washers at a daily pay-roll cost of $86.64. Due to the spray method, it was possible to lay off ten washers, which is a pay-roll saving of $45.60 per day. A 3-car-per-day output was maintained with the reduced force.

During the experimental period of May 11 to May 26, 1931, 44 jobs were washed by the spray method at a cost of 416 man-hours. Had these jobs been done by the hand method, they would have required 954 man-



Spray washing operation on a mail express car

hours. The saving per job due to the spray method was 12.23 man-hours, or $6.97. Details are given in the table.

The reduction in the man-hours per job amounted to 56.4 per cent, and the pay-roll reduction to 52.6 per cent, or practically the same. At present, the washing force consists of 5 men who turn out 2 cars per day. Were cars still being washed by hand, a force of 12 or 13 men would be required. The cars washed included all types, such as express, coach, sleeper, diner, parlor, etc. Both the insides and the outsides of these cars are spray washed.

The equipment used, as enumerated in the opening paragraph, has several advantages. It is portable and can be used anywhere in the shop or yard where air and water connections are present. Efficient shop operation requires this flexibility. It will permit quick, economical changing from one chemical solution to another, which is essential for the proper washing of our cars. The containers will carry a sufficient quantity of cleaning solution to provide economical washing. They will also permit solutions to be kept hot, and allow the equipment to be easily cleaned out, especially at the close of the day, without excessive waste or cost. The equipment gives a spray but no fumes. The equipment represents only a small investment and will work in conjunction with the air and water piping already present in the shop. Hot water for rinsing is provided by injecting steam, from the present steam pipes, into the water. Cold water passes through a steam jacket, where the steam and water are mixed to furnish hot water. Each of the 10 assigned wash tracks is provided with hot water, and the rinsing hose is connected directly onto the water line at the steam jacket.

Although no close check was made upon the material used under the spray system as compared with the hand system, there is seemingly little, if any difference in the amount and cost. The spray washing is under the direct supervision of the painter foreman.

Spray Cleaning of Trucks

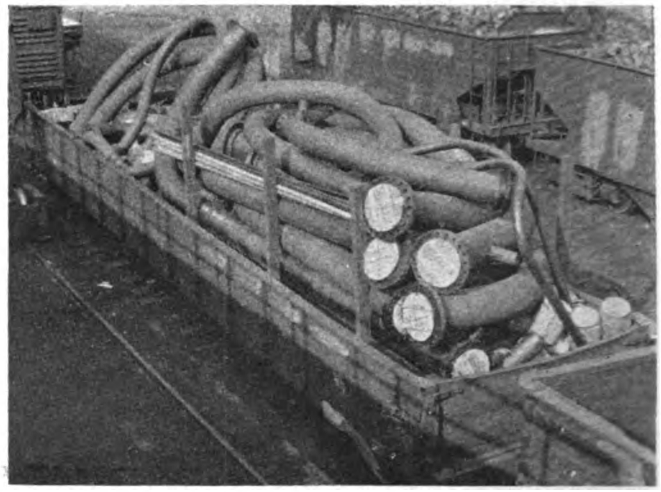
When spray washing of car bodies proved a success, the wash tracks took over the work of cleaning the trucks under cars. Formerly the dirt was blown off of the trucks by compressed air in the yard. This work cost about one man-hour (57 cents) per day and required at least two extra movements on the transfer table. The trucks are now washed along with the outside of the cars, thus eliminating the extra cost and movement. Furthermore, the trucks are cleaned much better than they formerly were. No man-hour or direct monetary saving has been claimed for truck washing.

Method of Loading Curved Pipe

IT is not unusual for car inspectors located in pipe or mill districts to be called on by shippers for advice as to the safe loading and securing of loads such as the one shown in the illustration, and for which no provisions are made in the A. R. A. loading rules.

The pipe loaded in this car was originally straight lengths which had been shipped to a pipe-bending plant and which came out in many shapes.

While any safe method of loading would be satisfactory, it is sometimes difficult to locate the side stakes in the exact location desired due to lack of inside stake pockets. This can be overcome by cutting out one or two rivets which pass through the side sheets and stakes and inserting bolts through the wood stake and car side.



Loads of this kind present a real problem

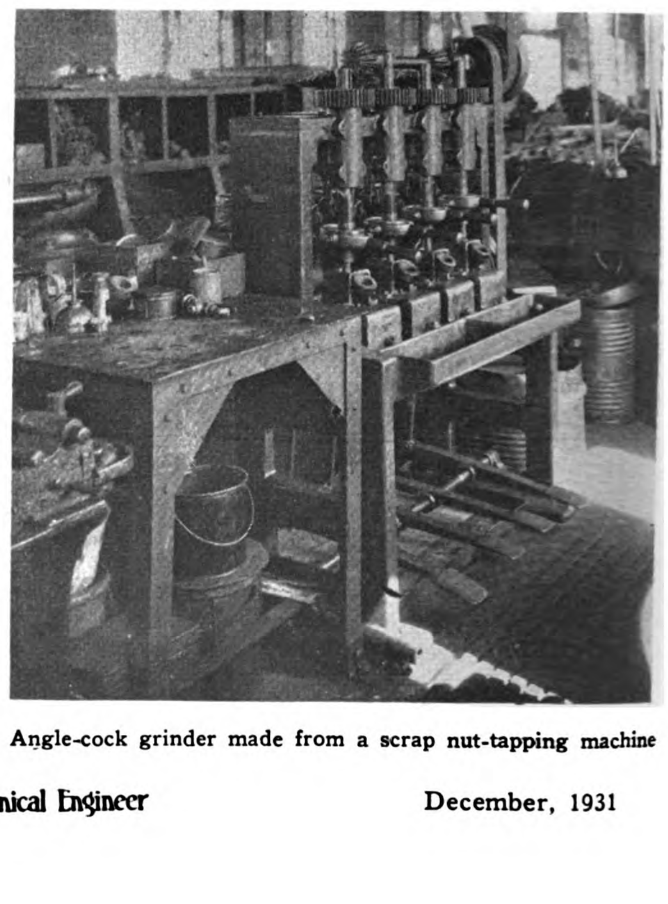
Because of the extreme weight of the pipe on the farther end of this car it was necessary to increase the size of the stakes to 8-in. by 8-in. and securely wire the pipe to this stake to prevent the shifting of the load in transit.

A most important factor in the loading of curved pipe is to see that the load is equalized throughout the car to prevent leaning and eventual shifting.

Angle-Cock Grinding Machine

By a General Foreman

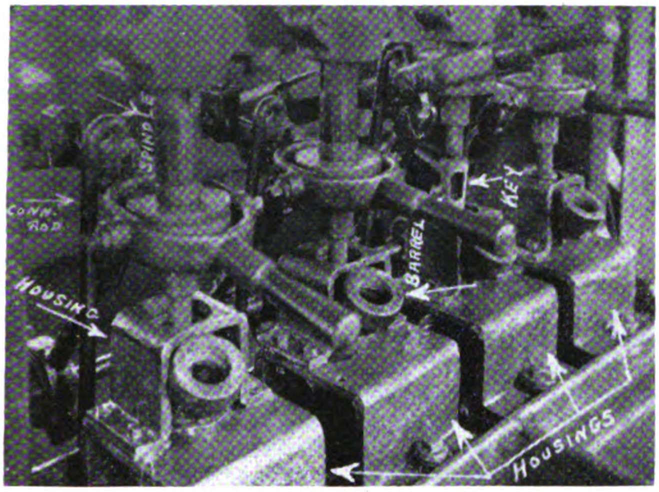
AN angle-cock grinder was described in the July, 1931, issue of the *Railway Mechanical Engineer*, page 373. From the description and illustration show-



Angle-cock grinder made from a scrap nut-tapping machine

ing the machine, it appears that the wearing parts are placed under the spindles so that, when grinding, the abrasive spills onto the wearing parts thus causing considerable wear. The grinding machine shown in the illustration overcomes this objection.

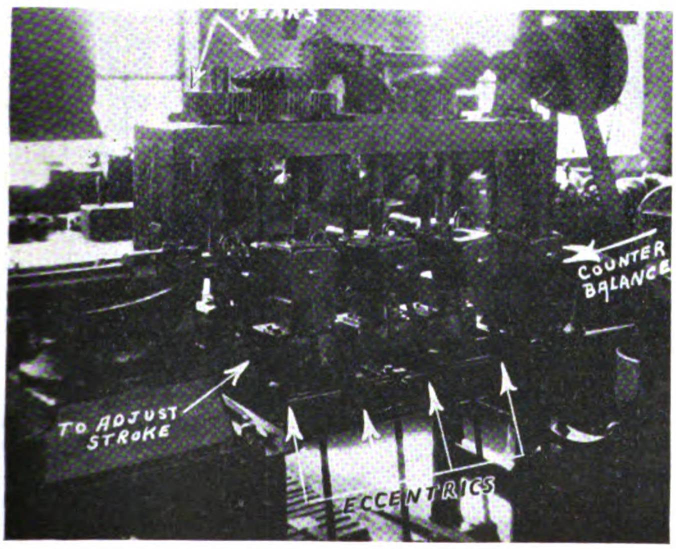
It is made from a scrap nut-tapping machine. The chucks for holding the nuts and the spindle chucks for



Front view of the angle-cock grinding machine showing the housings for holding the work

the taps were removed and housings for holding the work were substituted. The grinding head is keyed to the spindle to facilitate application and removal. To raise and lower the grinding head each spindle is provided with an operating handle and foot treadle. The foot treadle is connected to the extension arms of the handles with a goose-neck connecting rod. The raising and lowering mechanisms are counterbalanced so that the workman can operate the machine with comparatively little effort. A shaft provided with four eccentrics reclaimed from a scrap piston-ring grinder provides the required vertical movement of the grinding heads. The eccentrics are directly connected to the extension arm of the handle.

The gears and operating mechanisms are located above the work. It is impossible for the grinding compound to get into the gears and cause undue wear to the rubbing surfaces. This machine was in service a number of years previous to its conversion to an angle-cock grinder, but there has been practically no maintenance required to keep it in operation since its conversion. One-inch angle cocks may be ground by inserting a small iron block in the housing under the angle cock.

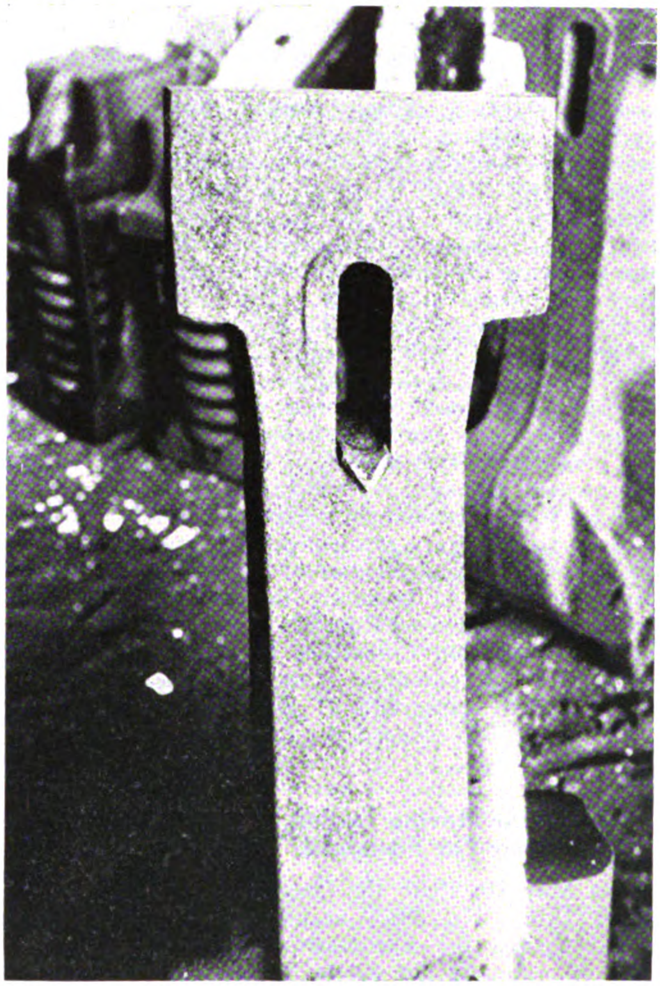


Rear view of the angle-cock grinding machine showing the eccentric and treadle arrangements

Taking Out Coupler Slack

ENLARGED keyways in couplers are responsible for a great deal of slack and while this wear can be corrected by welding it is not always convenient to do so due to the fact that at many of the smaller car-repair tracks no facilities are available for welding.

A satisfactory arrangement has been discovered by a car foreman on an eastern railroad, which consists of the application of a wrought iron shim or filler in the extreme end of the key slot. This filler can be made in various sizes and kept available in the car-repair yard for use when needed. The important thing is to get all, or as much of the slack as possible out of the coupler and by having several sizes of shims a suitable one can be used to make a tight fit. These shims can be manufactured in the larger forge shops on machines, or they can be made during intervals when the blacksmith in the car shop is not too busily engaged in other work.



Shims in the end of the keyway will take up the slack in the couplers

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Failure To Apply Arch Bar Of Standard Section

On May 6, 1930, the Clinchfield applied a second-hand arch bar measuring 1⅜ in. by 4½ in. by 83 in. to S. A. L. car 90196 at Erwin, Tenn., on account of the old bar being broken, owner's defects. The repair card as originally rendered did not show the dimensions of the bar removed. This information was added under date of September 9, 1930, at the request of the car owner and showed the same size bar applied as was removed. At the time the repairs were made, Rule 26 required that arch bars applied to 80,000-lb. capacity cars should be A. R. A. standard; namely, 1¾ in. by 4½ in., or 1½ in. by 5 in. Inasmuch as S. A. L. car No. 90196 was an 80,000-lb. capacity hopper car equipped with arch-bar trucks to which standard A. R. A. arch bars were applicable, the car owner contended that the application of the 1⅜-in. by 4½-in. bottom arch bar constituted wrong repairs and that the charges should be cancelled in accordance with paragraph 4, Rule 87, because the repairing line did not furnish a defect card at the time the repairs were made. The Clinchfield claimed that joint evidence had to be secured and repairs corrected before it could be required to cancel its charge. The second-hand arch bar applied to car No. 90196, the Clinchfield claimed, had been removed from a dismantled S. A. L. car of the same series. For that reason it contended that the 1⅜-in. by 4½-in. arch bar was the owners' standard for the car and that the application constituted permanent repairs and could not be considered as temporary repairs for which no charge could be made. The cancellation of the charge, it claimed, was equivalent to assuming the expense of repairs, which is prohibited by Rule 87.

The Arbitration Committee rendered the following decision: "The contention of the car owner is sustained under fourth paragraph of Rule 87, 1930 Code."—*Case No. 1680, Seaboard Air Line vs. Clinchfield.*

Charge for Moving Lading To Repair Car Sustained

On May 19, 1930, the Georgia & Florida repaired S. A. L. car No. 28829 at Douglas, Ga., the charges billed against the Seaboard Air Line amounting to $154.46. Among the several items of work done was one for renewing ten linear feet of siding. To do this work the load was removed and restored at the A end. The car is a double-sheathed, steel-frame box car. The Seaboard Air Line claimed that it was not necessary to remove the load to renail the siding. It contended that if the car had been improperly loaded so as to push the siding out, the delivering line should have been required to issue authority to transfer or adjust the lading, as the removal and replacement of the load in that instance was not a proper charge against the owner. It pointed out that the car had 13⁄16-in. outside sheathing and inside lining, that the steel upper frame was riveted to the outside of the side sills and side plate, making a solid superstructure between the siding and the lining, and that the repair card showed that it was unnecessary to remove or replace any of the steel upper frame; neither was any of the lining defective. This, the car owners claimed, indicated that the lining and frame were intact. The S. A. L. also contended that a space of 3 in. between the lining and sheathing was sufficient to enable the car force to renail the sheathing without disturbing the load. The Georgia & Florida in its statement pointed out that the car was loaded with bulk phosphate rock. It stated that while the car was on the rip track ten linear feet of outside sheathing was pulled back in place and renailed to the bottom-sill nailing girth, to prevent the contents of the car sifting through the opening. To perform this work properly the Georgia & Florida contended it was necessary to break the seal on the car door and remove and replace the bulk phosphate rock to remove the pressure on the siding in order to pull it back and renail to the side-sill nailing girth. The repairing line in its statement pointed out that the car was loaded on the Seaboard Air Line and delivered to the Georgia & Florida at Madison, Fla., at which interchange point neither railroad has an inspector. It contended that this was not a defect for which it could have called on the delivering line for transfer authority for the reason that the car could be repaired under load, which was done.

The Arbitration Committee in its decision stated: "Charge for R. & R. of lading to renail the siding is in accordance with Item 421 of Rule 107. The contention of the car owner is not sustained."—*Case No. 1681, Seaboard Air Line vs. Georgia & Florida.*

Chill-Worn-Flat Wheel Incorrectly Reported

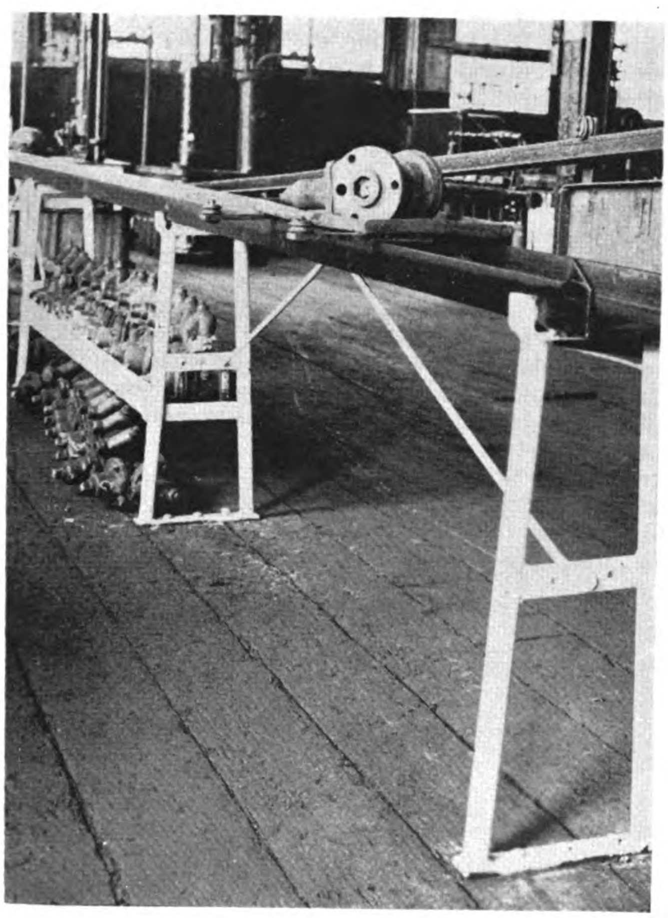
On September 26, 1929, S. A. L. car No. 13861 was repaired by the Atlanta, Birmingham & Coast at its Elyton, Ga., shops, when one pair of wheels were renewed on account of one wheel being "chillworn flat," the mate wheel being second hand, and a second pair renewed because one wheel had a worn flange. The mate wheel of the second pair also had the same defect which was discovered at the time by a remount gage. The owners requested the A. B. & C. to cancel the charges for the chill-worn-flat wheels and cited case No. 894 as being parallel. However, the A. B. & C. changed the repair card to read "Worn through chill flat," and refused to make any adjustment, claiming that practical men considered this term as describing an owner's defect. The Seaboard Air Line claimed that the terms "chill worn flat" or "worn through chill flat" are not recognized in the rules. It contended that the A. B. & C. changed its repair card after the bill had been rendered, which is prohibited by the rules, and also according to Cases 814 and 834. The S. A. L. also claimed that the corrected repair card which showed the wheels as worn through chill flat still indicated that the wheel was slid flat and that the repairing line should cancel its charge against the owner as per Rule 68. The A. B. & C. pointed out in its statement that the chief joint inspector made an inspection of the car at Birmingham, Ala., at the time it was received from the Louisville & Nashville, and issued his defect card covering a cut journal. On the same day the A. B. & C. forces at that point removed three pairs of wheels for the following defects already cited and declined to cancel the charge for the flat wheels, contending that the wheels were removed on account of owner's defect. It contended that Case No. 894, which was cited by the S. A. L. as being parallel.

had been made void by paragraphs 102 and 103 of the A. R. A. Wheel and Axle Manual which had been issued since the time the decision in Case 894 had been rendered, and said: "It is felt that the Seaboard Air Line is technical in its exceptions, because the owner assumes that the flat spots on these wheels were slid when the records of the actual inspection of the wheels developed that these were not slid-flat spots."

The following decision was rendered by the Arbitration Committee on April 10, 1931: "The contention of the Atlanta, Birmingham & Coast is sustained. Car owner is responsible on basis of Rule 73 and paragraphs 102 and 103 of the Wheel and Axle Manual."—*Case No. 1679, Seaboard Air Line vs. Atlanta, Birmingham & Coast.*

Progressive System of Handling Triple Valves

To eliminate the excessive cartage of triple valves in the air-brake shop the arrangement shown in the illustration was adopted by one railroad. A 15-in. channel is mounted on legs 36 in. from the floor and is of sufficient length to transport the triple valves past the various benches where workmen are engaged in performing their respective parts of the cleaning or repair operation. A number of carriages equipped with chair rollers are loaded with triple valves at the stripping bench and as they pass the workmen they are removed, repaired and replaced on the carriage and moved to the next operation. A ½-in. by ½-in. angle track located on the right of the channel is provided to return the empty carriages by gravity to the stripping bench.



A simple conveyor channel carries the triple valves past the work benches

This arrangement eliminates the necessity of trays or other cartage in the air brake shop and while presenting a systematic appearance also speeds up the work of repairing and cleaning, and reduces the cost per triple valve handled.

Questions and Answers For Air-Brake Foremen

Following is the fifth of a group of questions and answers selected from the instruction pamphlet recently revised by an eastern railroad:

Q.—Explain how to adjust high-speed reducing valves or brake-cylinder safety valves on engines equipped with the combined automatic and straight-air brake? A.—Adjust the straight air-brake reducing valve for about two pounds higher pressure than the standard setting of the high-speed reducing valve or safety valve to be adjusted; place the straight-air brake valve in application position, then manipulate the adjusting nut of the high-speed reducing valve or safety valve until a slight amount of air discharges from the exhaust of the high-speed reducing valve or vent holes in the safety-valve spring box; then reset the straight-air-brake reducing valve to 45 lb.

Q.—Explain how to adjust the high-speed reducing valve on engines not equipped with the straight-air brake? A.—Make a continuous service reduction of 30 lb. from an initial brake-pipe pressure of 110 lb. and note the pressure at which the high-speed reducing valve functions as indicated by the gage. If higher or lower than the required pressure, manipulate the regulating nut until the required pressure is returned after adjustment is completed. Repeat this operation if necessary until proper adjustment is made.

Q.—What test is required with respect to the independent brake valve? A.—It should be placed in slow-application position noting that the brakes apply; then placed in lap position, noting that brake-cylinder pressure remains constant.

Q.—What should then be done? A.—Release the brakes, then place the independent brake valve in quick-application position noting that the brakes apply at a more rapid rate than in slow-application position.

Q.—What brake-cylinder pressure should be obtained? A.—45 lb.

Q.—What should be noted with respect to distributing-valve operation? A.—That it operates noiseless and without vibration.

Q.—What should be noted with respect to the brake-valve handle when released? A.—That it returns to slow-application position.

Q.—What brake-cylinder pressure should be obtained through the straight-air brake valve? A.—45 lb.

Q.—What should be noted following an independent or straight-air brake application when the independent brake valve is placed in running position, and the straight-air brake valve placed in release position? A.—That the brakes release.

Q.—With brakes fully applied and with the automatic brake valve in lap position what test should be made of the independent brake valve and the distributing valve? A.—The independent brake valve should be alternated between independent running and release position at the same time noting that it is possible to reduce the brake-cylinder pressure in steps of about 7 lb.

Q.—What may cause failure of brakes to apply when the independent brake valve is placed in application position? A.—Reducing valve not properly adjusted; slow application port in the independent rotary valve or application-cylinder pipe obstructed; distributing-valve supply-pipe cut-out cock or brake-cylinder cut-out cock closed; bad leak from the application cylinder; distributing-valve release pipes or safety valve leaking or not properly adjusted.

Q.—What may cause a failure of the brakes to remain applied after an independent application with the independent brake valve in lap position? A.—Leak in the application chamber or cylinder, application-cylinder cover gasket, application-cylinder-pipe or fittings, distributing-valve release pipe or fittings, safety valve, independent rotary valve, seat or lower gasket or automatic rotary valve or seat.

In the

Back Shop and Enginehouse

Maintaining Bearings On Motor-Car Engines

By E. O. Whitfield

THE New York, New Haven & Hartford has developed a large number of special tools and fixtures for use in connection with the maintenance of rail-motor cars. Some of these devices have been referred to in previous articles by the writer which have

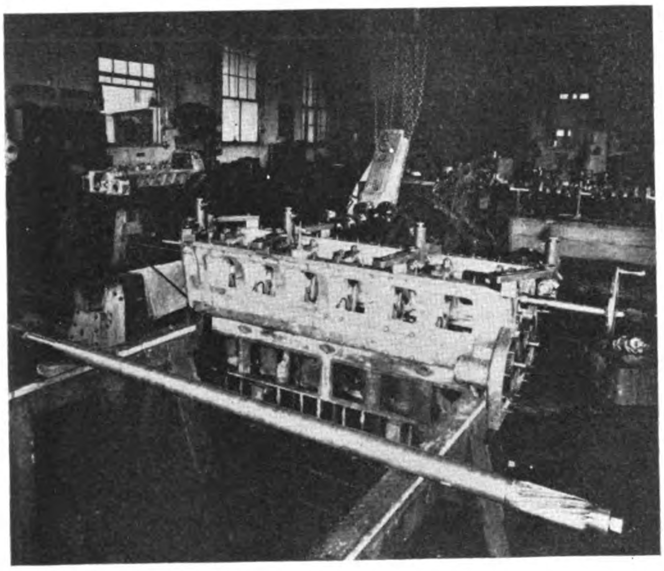


Fig. 1—Engine set up for boring the crank-shaft bearing seats

appeared in preceding issues of the *Railway Mechanical Engineer* while others have been described in detail.

Undoubtedly one of the most important jobs in a shop devoted to the maintenance of rail motor cars is the maintenance of engine bearings, especially the main bearings. Accuracy and fine workmanship are essential.

Referring to Fig. 1, the cam-shaft reamer shown lying across the two horses in the foreground is one of the tools developed in the New Haven, Conn., shops. The special attention of the reader, however, is referred to the boring bar which is shown inserted through the crank-shaft bearing seats of the engine in the foreground.

The bar *A*, which is shown assembled in Fig. 2, is fitted with fly-cutters *H* and is turned with the hand wheel *D*. This handwheel fits on the end of the bar. It is also used for other operations in connection with facing bearings, as shown in Figs. 3 and 4.

It is possible with the boring bar *A* to work to tolerances of .0005 in. The mounting brackets *C* are hinged to the bar bearing piece and can be adjusted to suit the location of the studs, as shown in Fig. 1. The bar and hand wheel are mounted in the crank case, with the assistance of the alining bushings *B* which fit loosely in the crank-case bearings and can be moved along the bar to suit. A dial indicator *F* is used to center the bar and cutter accurately in the bearing.

After a crank-case bearing has been bored, the mounting bracket and bar bearing are slipped out; the cutter *H* is moved to the next crank-case bearing and the bracket and bar bearing are replaced. The feed nut *G*, like the four bar bearings, is also made in halves hinged together so that the two halves can be opened and moved along the bar. In this manner the feed nut can be easily moved to the opposite end of the feed thread after a cut, while the bar is slipped back.

The boring bar is of cold-rolled steel, 1¾ in. in diameter. The bar-bearing assemblies *C*, Fig. 2, are adjustable vertically and horizontally. The feed nut *G* is held in position by the clamps *E*. As shown in Fig. 1, the lower halves of the crank-case bearings are securely bolted in position previous to the boring operation.

Fig. 3 shows all of the parts of the main-bearing boring assembly. Referring to the lettered designations: *A*, are adjustable mounting brackets and boring-bar bearings; *B*, adjustable fly-cutter head; *C*, boring bar; *D*, feed nut; *E*, locating or alining bushings; *F*, holding clamps for the feed nut *D*, and *G*, hand wheel for operating the boring bar. Parts *H* to *M*, inclusive, are the details of the tool shown in Fig. 4 for cutting the fillets and facing the sides of the connecting-rod bearings.

Referring to Fig. 4, *A* is a facing tool; *B* is a wrench for tightening the mandrel, and *C* is the hand wheel for turning the cutter. The parts of the expansion mandrel are shown in Fig. 3, designated *J*, *K* and *L*.

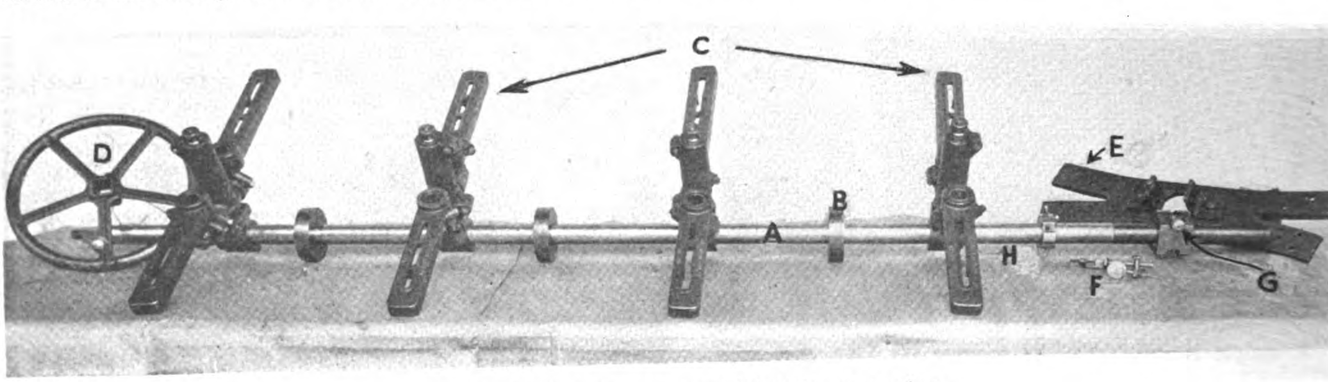


Fig. 2—Boring bar as assembled for operation

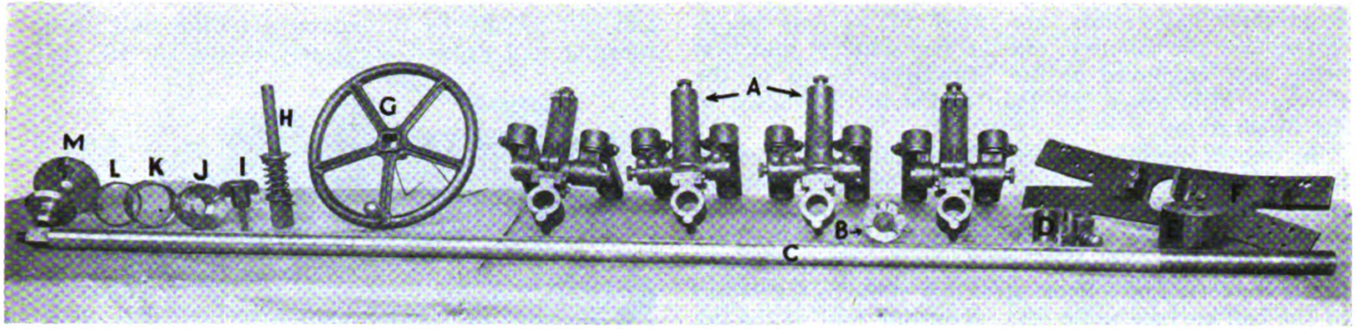


Fig. 3—Details of the boring-bar for crank-shaft bearing seats and the facing and filleting tool for connecting-rod bearings

The details *H* show the turning bar and feed spring, and *M* is the cutter head.

The connecting rod is held in a bench vise. The arbor is expanded in the bearing. The feed springs are

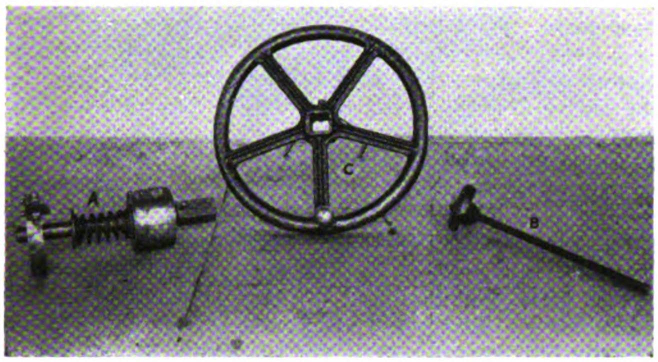
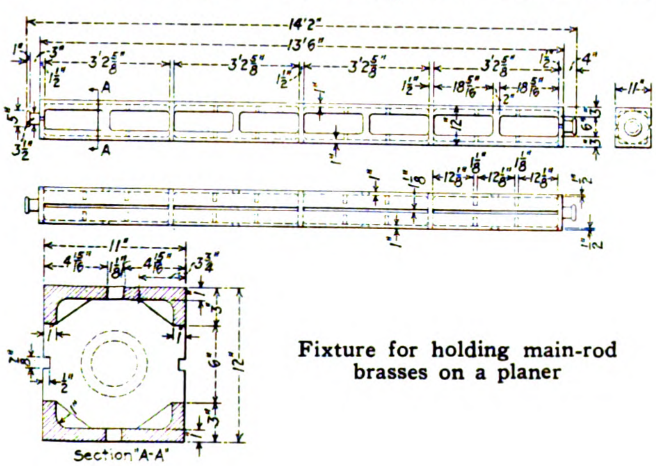


Fig. 4—Facing and filleting tool for connecting-rod bearings

then compressed and the cutter head *M* is secured to the shaft *H* with the wrench *B*, Fig. 4. Thus the cutting tool is held firmly against the cheek at the bearing.

Machining Main-Rod Brasses on a Planer

THE fixture shown in the drawing is used by an eastern road for holding main-rod brasses on a planer. It is made of cast iron and the pattern can be built to any convenient length. Referring to the top view, two keyways are provided—one at each end of the casting. As shown in the end view, these keyways are on the reverse side and are for the purpose of keeping the fixture in alignment on the planer. Either of the



Fixture for holding main-rod brasses on a planer

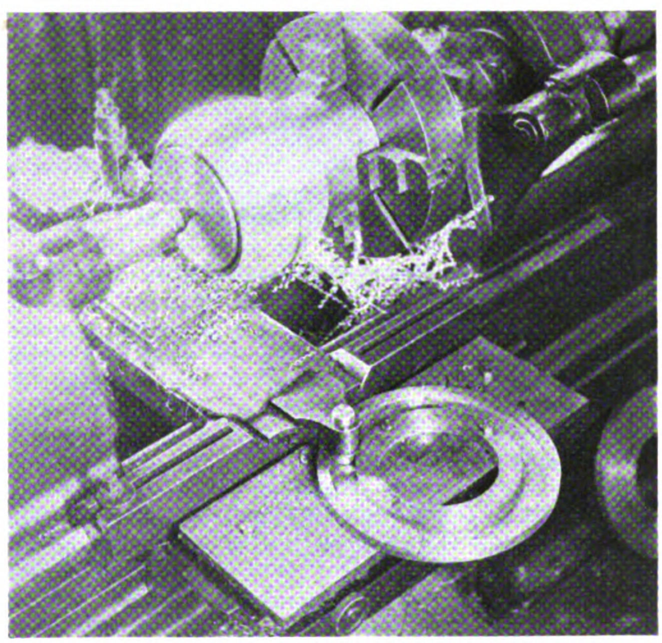
two keyed sides can be placed on the planer table.

The fixture is clamped to the table by two or more bolts, which are inserted through the openings shown in the top view. The main-rod brasses are sweated together, with one side faced, and placed on either or both sides of the fixture, depending on the number to be machined simultaneously. The $1\frac{1}{8}$-in. slots shown on opposite sides are used for clamping the brasses.

The trunnions at either end of the fixture are provided for the purpose of rotating the jig and brasses to avoid having to loosen and fasten the brasses again to finish another side. This feature also assures the sides being exactly parallel, provided, of course, that the sides of the fixture are parallel.

Machining Large Ball Joints

ONE of the railroad shop operations which requires the most exacting care is the machining of ball joints in the large steam pipes used on articulated locomotives. Both the ball joints on the steel pipes, as



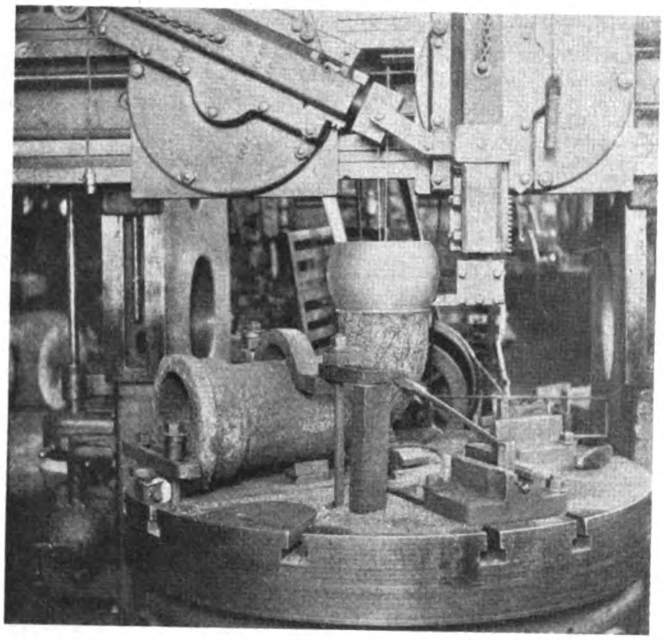
Forming a steam-pipe ball end on an engine lathe

well as the brass packing rings commonly used to make the joints steam tight under the swiveling action when locomotives are rounding a curve, must be machined accurately and smoothly to hold the steam.

A number of satisfactory methods of machining large

steam-pipe ball joints are used in various shops throughout the country, one of the simplest and best being that employed at the Milwaukee shops of the Chicago, Milwaukee, St. Paul & Pacific, as shown in the illustrations.

In one of these views, an ell is shown clamped to the table of the boring mill with the ball end centered over the table center. The left boring mill head is clamped rigidly in the position shown, the cross-feed screw being removed from the right head and the two heads connected by a short steel link equal to the radius of the ball surface to be cut. A cutting tool of the desired shape is set in the tool post, and vertical feed of the right head cuts a spherical surface on the steel pipe.



Machining a steam-pipe ball end on a boring mill

The operation is not quite as easy as it sounds, since the cross feed must be obtained by hand adjustment of the cutting tool so that when the final finishing cut is taken an accurate spherical surface of the required diameter will result. After set-up of the machine, the production time required for this machining operation is approximately 2½ hours for each steel ball end.

A somewhat similar method is used in the case of the ball joint shown in the second illustration. This steel ball is threaded and screwed onto a special mandrel, chucked in an engine lathe with the outer end rigidly supported by a circular plate and the tail centered.

A circular plate provided with a groove of the same center line diameter as the ball to be turned, is secured to the taper attachment of the lathe by means of three cap screws. With the cross-feed screw removed from the tool slide and a roller fitting in the groove, longitudinal feed of the carriage will cause the cutting tool to cut a ball surface.

As mentioned, the machining operation is one requiring more than ordinary care and a witness mark is usually carried at the center of the ball until the surface has been roughed out and calipered to assure that the correct shape is being attained. A final finishing cut then removes the witness mark and gives a smooth, accurate ball surface.

The machining of the brass packing rings does not occasion so much difficulty, inasmuch as the rings have a relatively narrow bearing surface on the steel balls and can usually be turned on a boring mill, using a forming tool ground accurately to the correct radius.

A Quick-Acting Clamp for a Slotter

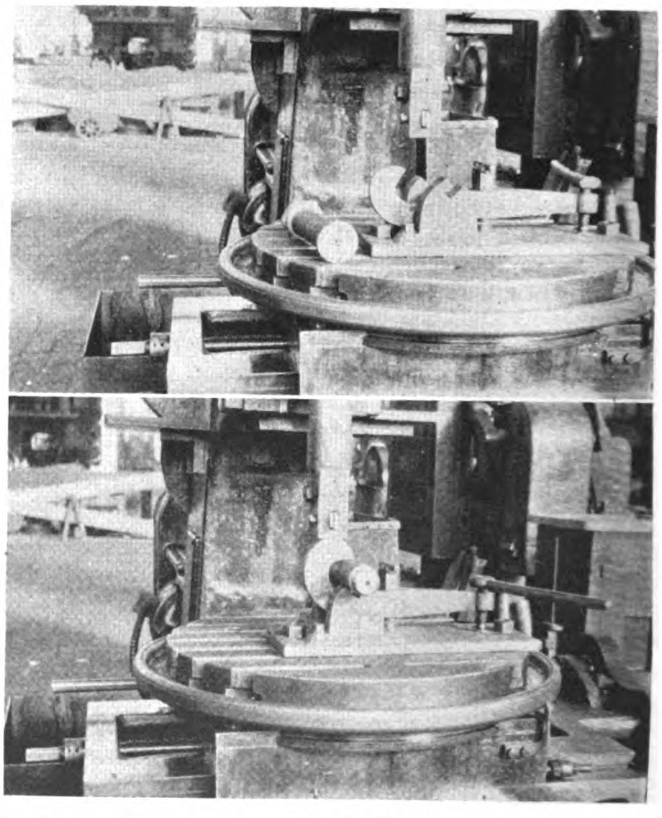
By H. W. Payne

SHOWN in the illustration is a quick-acting clamp designed to hold locomotive spring-hanger pins on a slotter when cutting the notch on the head. The clamp can also be used for other purposes, such as holding pins or studs on a drill press for drilling cotter-pin holes, etc.

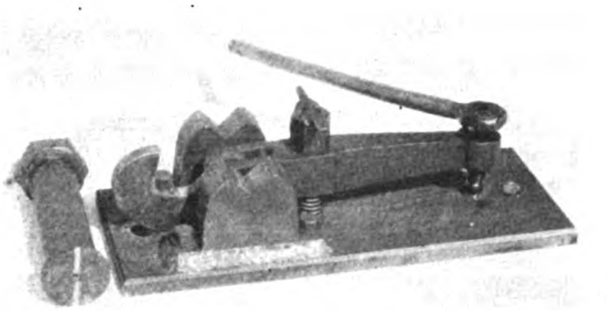
It consists of two V-blocks electrically welded to a base plate, a lever with a hinged hook on one end, and a cup-pointed set screw on the other. A stud, which serves as a fulcrum for the lever, is set vertically in the base plate. At this fulcrum point the lever rests on a coil spring around the stud which holds the lever up against the nut on the stud. The hole in the lever for the fulcrum stud is sufficiently large to permit free angular movement of the lever in a vertical plane. A short piece of round bar iron is welded across the top of the fulcrum-stud nut and serves the same purpose as a wing nut. The set screw seats on a ¾-in. steel ball which is electrically welded to the base plate. A socket wrench is provided for adjusting the set screw.

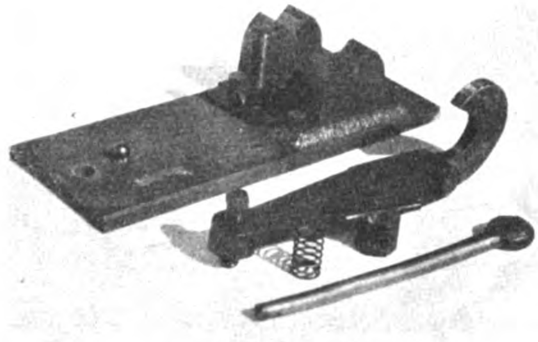
The hook and lever are adjusted to the diameter of the work by turning the fulcrum-stud nut up or down as required and adjusting the set screw to suit. The set screw forces the lever up, which causes the hook to bear against the work, clamping it securely in the V-blocks.

When the proper adjustments are made to suit the diameter of the work, a half turn of the set screw will



Two views of a clamp for holding round pieces on a slotter or drill press





Top: Clamp assembled—Bottom: Detail parts of the clamp

clamp or release the work. The fulcrum-stud spring permits a quick release of the hook when the pressure is released at the end of the lever. No further adjustments are required for additional pins after the clamp has once been adjusted.

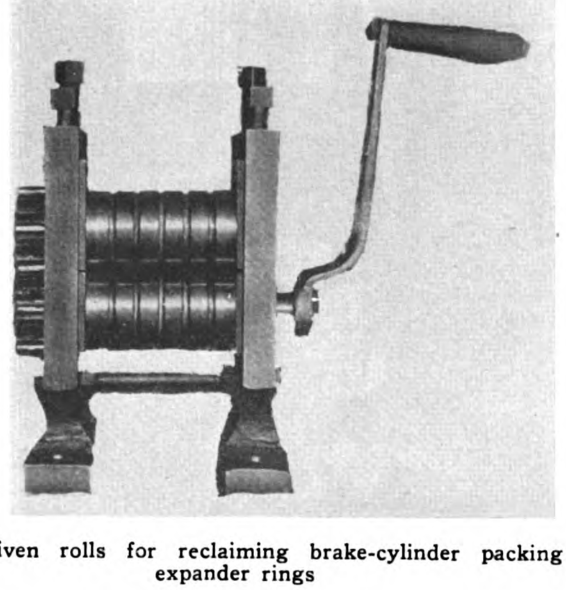
Reconditioning Expander Rings

By R. T. Skinner

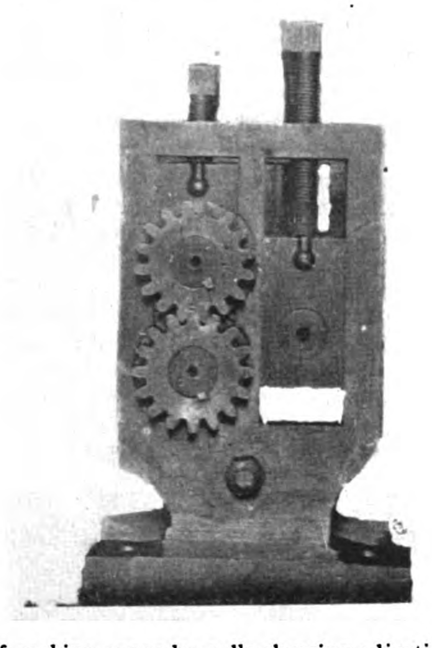
A LARGE number of brake-cylinder packing expanders, or expander rings, for use in locomotive and car brake cylinders, become distorted in service or subsequent handling and require reconditioning before they are used again. The method sometimes followed of annealing the expanders, truing them on the anvil and retempering is too slow and involves so much labor as to make the cost practically prohibitive. Moreover, it is almost impossible to turn out a true ring with just the desired amount of opening at the ends and resultant uniform spring pressure against the packing.

To overcome these difficulties, a small and simple set of hand-driven rolls, illustrated, was designed, made of tool steel and grooved to accommodate different sizes of expander rings. The first and second grooves from the left take care of 8-in. and 10-in. rings used in car-brake cylinders. The center groove accommodates 12-in. and 14-in. rings, used in locomotive brake cylinders, and the large groove on the right accommodates 16-in. and 18-in. expander rings, used in Pullman passenger-car brake cylinders. As many as 270 10-in. rings and 255 8-in. rings have been reclaimed in one day at a central reclamation point to which quantities of expander rings are shipped, and the net saving is at least 50 per cent of the cost of new rings.

The construction of the packing-ring expander rolls is shown in the illustrations. The lower grooved roll, revolved by a handle, drives the upper roll, correspondingly grooved to grip the ring, by means of two small spur gears better shown in the end view. A plain idler roll in the rear serves to give the required curvature to the ring as it is passed through the device. All rolls are capable of adjustment to give the desired results in reclaiming the rings by means of set screws. A checking block may be used to make sure that the rings conform to standard dimensions and have the required opening.



Hand-driven rolls for reclaiming brake-cylinder packing expander rings



End view of packing expander rolls showing adjusting screws for the upper grooved roll and the idler roll

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THE PUBLIC HEALTH DEPARTMENT of the Province of Ontario has recently received a completely equipped dental car, for use in the northern part of the province. The car, loaned to the Ontario government by the Canadian Pacific, was converted, at the railroad's Angus shops, from a sleeper into a dental laboratory, with living accommodations for a doctor and nurse. It will be maintained by the government, and will have free running rights over all northern Ontario railways.

Oil-Fired Forges

WHILE considerable sentiment no doubt attaches to the old type of coal-fired forge used for so many years in railway blacksmith shops, there can be no question about the advantages of modern oil-fired forges, from the point of view of cleanliness and production in territory where the necessary fuel oil can be secured at reasonable rates.

The illustration shows an installation of modern oil-fired blacksmith forges at the Milwaukee shops of the Chicago, Milwaukee, St. Paul & Pacific. The forges are of the round, side-fired type, equipped with Johnston burners and air under pressure from the shop blower line. There are about 20 of these forges in the blacksmith shop which, together with all other furnace equipment in the shop, are oil-fired.

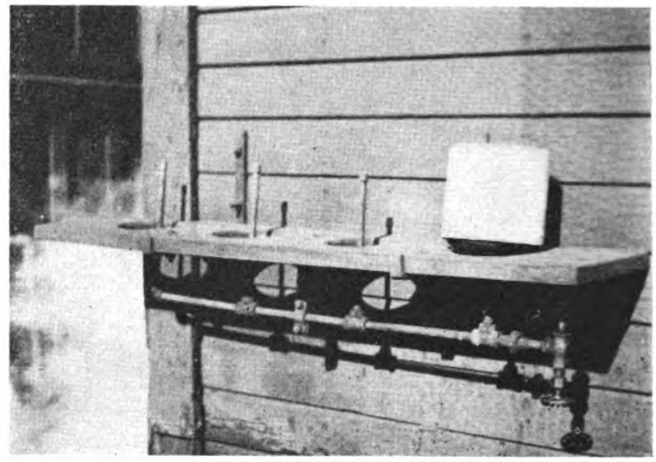
Referring to the illustration, the general construction of the forges will be evident. An arch is built of fire-brick over the fire and just high enough to enclose the steel bar or part to be heated. A large fixed sheet-iron shield serves the double purpose of keeping drafts away from the fire and confining the heat to each individual forge. An additional movable shield, which can be readily swung out of the way when not in use, also serves to confine the fire and protect the blacksmith who is working at that forge.

Experience with this equipment at the Milwaukee shop indicates that it contributes substantially to increased production and a cleaner shop. Moreover, after a little experience, a better quality of work is turned out. Even welding, at first considered inpractical with oil-fired forges, is now handled with entire satisfaction, and the blacksmith force prefers this type of furnace.

In addition to the advantages mentioned, there is a saving of 20 min. shop time in the morning formerly required for kindling coal fires, and the labor of handling coal and ashes is also saved. At the Milwaukee shops, one man on the second shift lights all forges about 10 min. before the whistle blows.

Sterilizing Water Jugs

A CONVENIENT and sanitary arrangement for the sterilization of trainmen's and enginemen's water jugs is shown in the enclosed illustration. A ⅜-in. pipe leading from the radiator line in the supply room to a shelf attached to the outside of the building

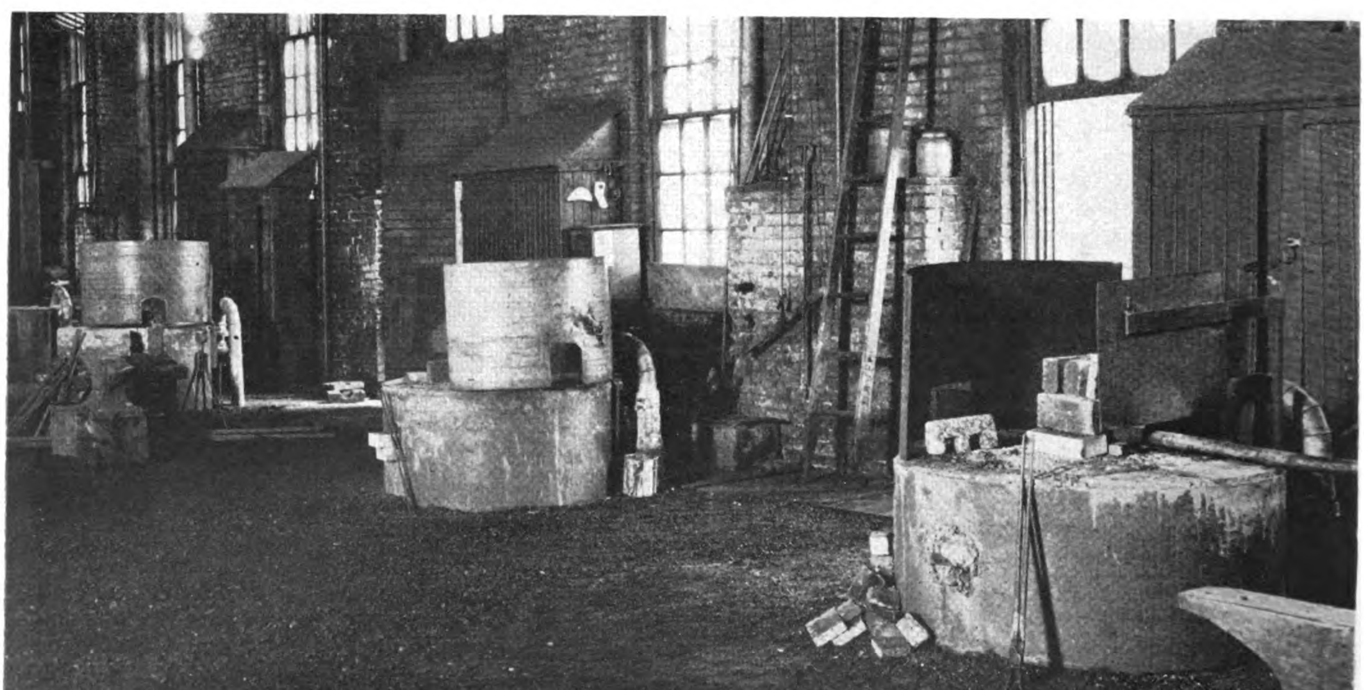


Steam pipes projecting up through the shelf provide a handy method for sterilizing water jugs

will furnish sufficient steam to sterilize the jugs.

The capacity of the shelf and the number of exhaust nozzles needed depends on the number of water jugs handled; however for a terminal despatching from 75 to 100 engine crews daily, the four-connection arrangement as shown is ample.

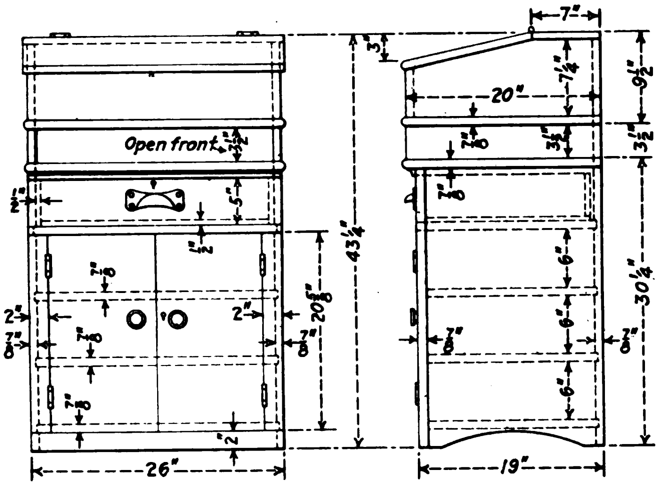
Before being sterilized the water jugs are thoroughly washed on the exterior with soap and water and the last sterilizing date is removed from the bottom of the jug. After jugs are removed from the sterilization rack, they are again stencilled so as to indicate to the engine crew that they are sanitary.



Oil-fired blacksmith forges at the Milwaukee shops of the C. M. St. P. & P.

Combination Tool Box And Cupboard

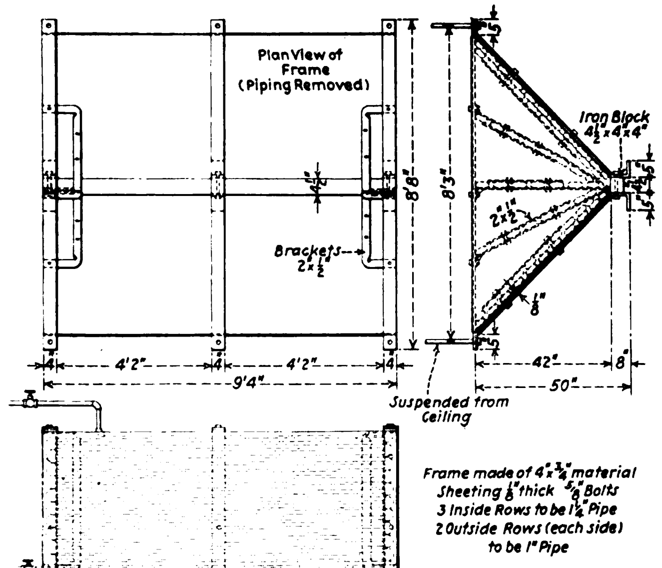
THE combination tool box and cupboard shown in the drawing is one of the standard facilities used in the back shops and engine terminals of an eastern railroad. It is made of poplar and is 43¼ in. high by 26 in. wide. A depth of 19 in. affords commodious shelf and cupboard room.



A combination tool box and cupboard for machine operators

Dryer for Locomotive Sand

SHOWN in the drawing is a hopper and steam-coil arrangement designed to dry sand for locomotives. The hopper is made of ⅛-in. sheet steel and is suspended from the ceiling or roof structure by six ⅝-in. rods or bolts. The frame for the hopper is made of 4-in. by ¾-in. bar iron. The heating coils are arranged in five sections. The three inside sections are of 1¼-in. pipe and have a single row of pipe coils. The two outside sections are of the same size pipe but have a double rows of pipe coils.

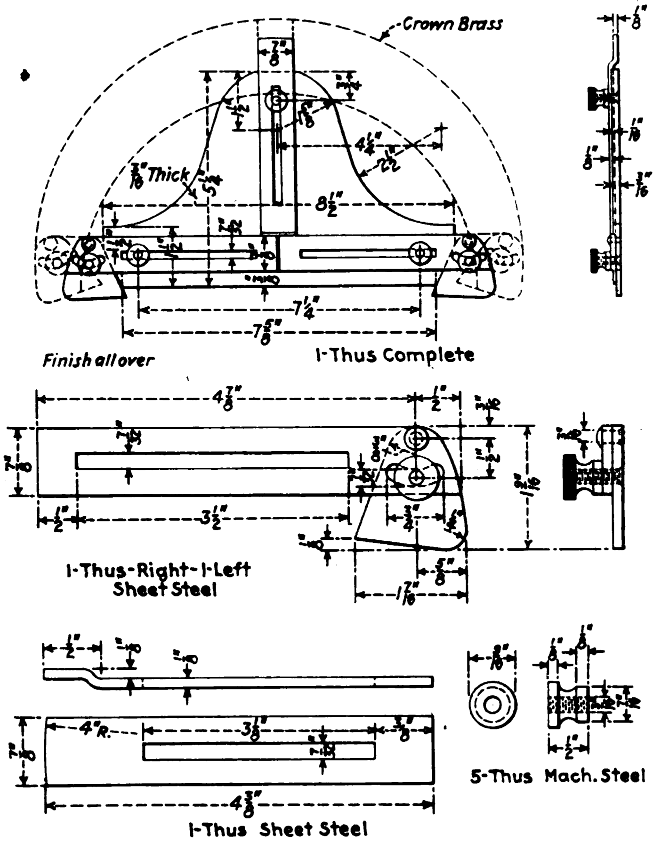


Overhead hopper and steam-coil arrangement for drying sand

Fitting Crown Brasses To Driving Boxes

THE adjustable gage shown in the drawing is designed for transferring the measurements taken from the inside of a driving box to the edge of the crown brass which is to be fitted to the box. When in use the thumb screws of the gage are loosened, the vertical arm of the gage is set against the top of the box on the center line, and the horizontal arms are set to locate the lower sides of the crown brass. The gage setting to mark the outside edge of the crown brass is indicated on the drawing by dotted lines. The thumb screws are tightened when the three adjustable arms have been set to the box and the gage is then applied to the edge of the crown brass for laying off.

The gage is made of ⅛-in. and $\frac{3}{16}$-in. sheet steel.

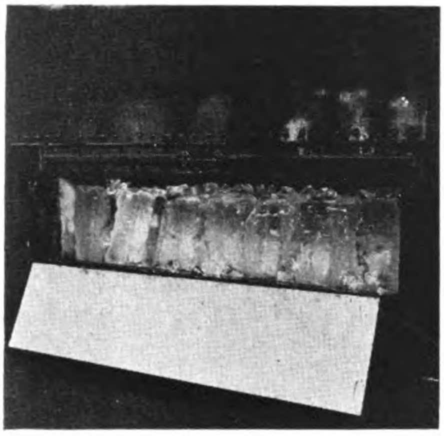


Adjustable gage for laying off the edge of crown brasses when fitting to driving boxes

A MECHANICAL OFFICER'S HOBBY.—The hobby pursued by Henry B. Bowen, chief of motive power and rolling stock of the Canadian Pacific, during his spare hours is not far removed from his every day work, in that hobby and life work both deal with machines. But in another sense the two are far apart, for the hand that runs machine shops by scratching a pen in the day time itches for the control of a lathe after working hours. In the basement of his home in Montreal Mr. Bowen has what is considered to be the most complete private machine shop in that city. Here he spends hours of leisure time, and his principal product is model stationary and marine engines. And his marine engines have been put to practical use. His three sons operate a fleet of five model steamboats on Echo Lake in the Laurentian mountains, Mr. Bowen's summer home. The latest product of the Bowen shop is a 4,000-r.p.m. marine engine which is only 4 in. in height. One of the devices in the shop is a milling machine which Mr. Bowen designed and built. In this shop have also been evolved a number of tools which are in regular use in the railway's shops.

Conditioning the Air In Passenger Coaches with Ice

The R. B. Engineering Corporation, 11 West Forty-Second street, New York, in co-operation with the mechanical department of the Boston & Maine, has developed a system for conditioning the air in passenger cars by the use of ice as a cooling medium. This development was sponsored by the Metropolitan Ice Company, Boston, Mass., and the installation was made by the Boston & Maine. The system consists essentially of two ice bunkers, two blower fans, a circulating pump, two dirt and dust filters, and four coolers of the automobile radiator type.



Bunker charged with ice

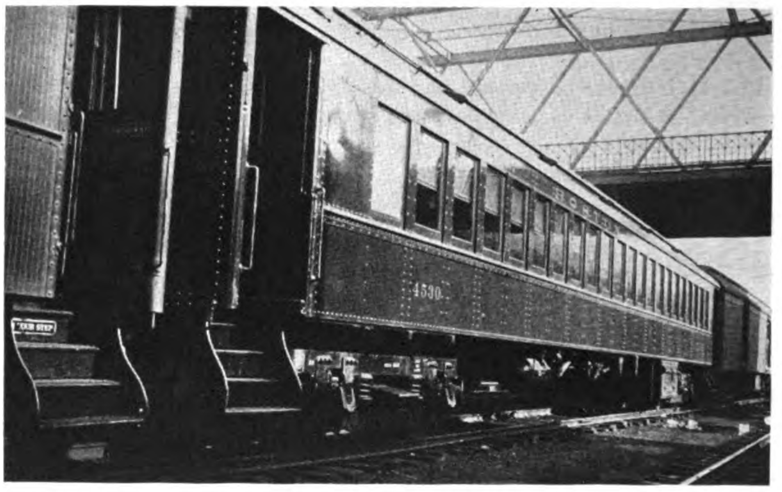
The source of refrigeration is ice, the ice being carried in bunkers beneath the car. Water which is cooled by being sprayed over this ice is circulated by pumps through concealed fin-tube radiator-type coolers at either end of the car. Air, cooled by passing through these cooler units, is then drawn across the car ceiling from end to end, thus lowering the temperature gradually and without draft. The air is automatically dehumidified at the cooling surfaces and is separately filtered. It is kept under slight positive air pressure, which prevents outside dirt and dust from entering.

The air-circulation system maintains rapid circulation over the heads of the occupants, such that the resulting static pressure and relative air densities allow cold air to pass down as it will from the main stream. All air circulated is refrigerated.

The air is discharged into the passenger compartment at high velocity from one opening (the lower one in the illustration). The air circulates the full length of the car to a return-air opening, which is located in the partition at the opposite end. The location of the discharge and return air openings are reversed with respect to the locations in either end so that the discharge outlets are in direct line with the return-air openings. With fans operating at both ends of the car, the air streams flow in opposite directions on the two sides of the car. The relative paths of air travel are maintained by a blowing, as well as a suction action. If one blower stops, or if the speed is lowered, the scheme of air circulation fails to function. But with the system functioning as it is designed to operate, conditioned air is circulated without draft at the level of the passengers' heads, in all parts of the car. Anemometer readings showed clearly that two distinct, ductless streams are flowing, with the same velocity but in opposite directions:

The schedule of equipment follows:

1 standard 450-amp.-hr. battery
1 standard 5-kw. generator
2 insulated ice tanks, 800 lb. ice capacity each
1 Gould centrifugal pump with ¾-hp. motor
2 "Protectomotor" dry-felt air filters, 45 sq. ft. each.
2 Sturtevant blowers, Type 0, 140 c.f.m., ¼ in., with ½-hp. motor
4 McCord radiators, 24 in. by 18 in. by 3.25 in., 160 sq. ft. each, all copper



Boston & Maine coach No. 4530 equipped for conditioning air with ice

In operation the air circulation system is "wide open." There are no automatic controls and no dampers. The amount of outside air depends entirely on the pressure in the car, which is always positive. The slight pressure keeps air circulating out through window and door

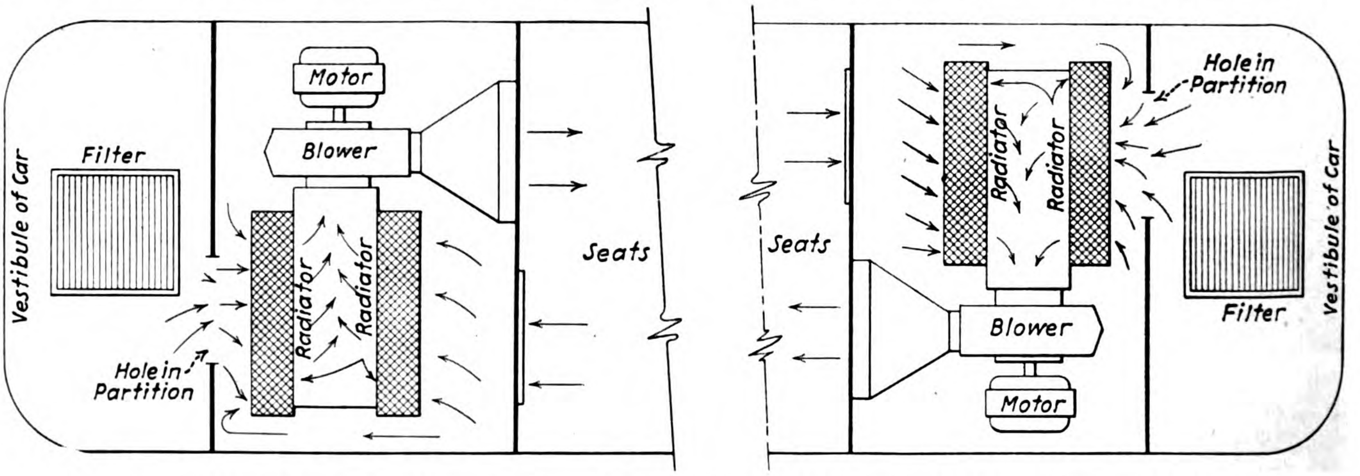
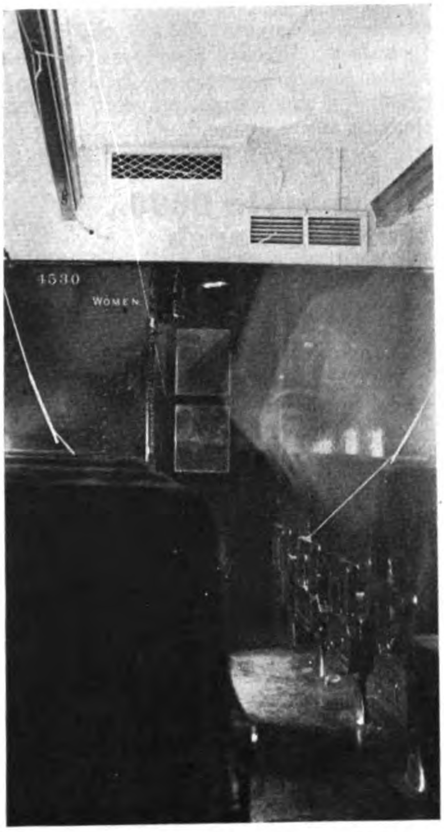


Diagram of air-conditioning system using ice—This equipment is set above the ceilings at the two ends of the car



Cool air is discharged through the lower opening while the opening near the ceiling is the return-air intake—This arrangement is reversed at the opposite end of the car

crevices and eliminates dust and smoke infiltrations.

The battery, generator and ice bunkers are located underneath the car. The centrifugal pumps, blowers and remaining equipment are located above the two vestibules, as shown in the diagram of the water-cooling system.

Robert T. Brizzolara, president of the R. B. Engineering Corporation, reports the following relative to a test run made with the experimental car: "The maximum amount of fresh air drawn in at any time was about 20 per cent. Some mild churning of air between the two opposite streams could be observed in the center of the car above the level of the heads, but it was not of consequence.

"The filters were made of aluminum grids covered with a large area of special felt. The cleansing effect of the radiators was evident from the clear air in the car with several men smoking. With 60 passengers the same results were noted.

"There was no car precooling or any preliminary attention whatever, and the system was not started until the train was under way. The results were not obtained in anticipation of publication nor as an ideal demonstration, as the attendants experimented with louvres, fan speeds and water flow to the degree that the temperatures are not especially uniform. Neither were they as high as the public required for comfort. However, we found it quite practicable to have a controlless car after a fixed setting of all equipment is made. Its satisfactory performance will be improved by the installation of a thermostatic control on the ice-water supply line. We ran temperatures that were 10 to 16 deg. F. lower than those that prevailed outside and 14 to 19 deg. F. lower than those in other cars of the same train. The humidities were quite within those ordinarily required in conditioning work of any sort.

"Runs between Boston and Portland, Me., have been made with 60 passengers in the car, maintaining 16 deg. F. lower temperatures than outdoors. The ice consumption averaged 600 lb. of ice per hour, a refrigerating rate of 7.5 tons."

Two of the tables give logs of observed data, including the ice and power requirements for a five- to six-hour run on a cool day and a warm day.

Carbide Tips On Cutting Tools

A new method of applying carbide tips to cutting tools has been developed recently by the Ramet Corporation of America, North Chicago, Ill., and is now being used in many of the tantalum-carbide tools manufactured by this company and its licensees.

An insert of pure molybdenum is brazed between the steel shank and the tantalum-carbide tip. Molybdenum inserts, having almost the same coefficient of expansion as the tantalum-carbide alloy, effectively prevent strains being set up or cracks developing in the cutting tips as the tools cool after the brazing operation. Such strains as may develop between the molybdenum insert and the steel shank are entirely absorbed by the molybdenum, due to its great ductility.

Inserts of molybdenum are especially desirable in tools where the carbide tips are long, thin, or of unusual shape; or where unusually severe conditions of operation are expected.

Lunkenheimer "Glaswick" Oil Cup

A wick oil cup is being marketed by The Lunkenheimer Company, Cincinnati, Ohio, which provides automatic lubrication, visibility of oil supply, maintenance of constant oil level with consequent uniform feed, and ease in replenishing the oil supply. The "Glaswick" oil cup has a capacity of approximately four ounces of oil. It consists of a steel cup with a shut-off cock in the shank, and a glass bottle which fits over the top of the cup. The bottle is held securely to the cup by

A wick oil cup with a glass reservoir and a shut-off cock

means of a steel wire and clamp. Tight closure between glass bottle and steel cup excludes dirt.

When placed in service, the steel cup is filled with oil. The glass bottle is also filled and placed in an inverted position over the steel cup. Visible presence of oil in the glass bottle is assurance that the steel cup is full and that the wick is absorbing sufficient oil to insure a constant uniform feed to the bearing. The desired rate of feed is obtained by determining the number of strands of wick to be used, and the oil then feeds at a uniform rate; the cup needs no further adjustment. When replenishing the oil

Observed Test Data on Boston & Maine Coach No. 4530, Sept. 9, 1931 Sept. 10, 1931

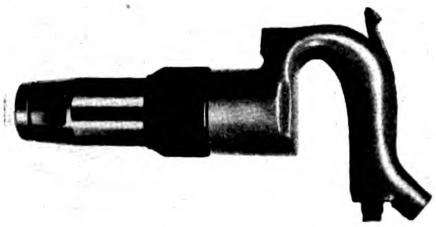
	Sept. 9, 1931					Sept., 10, 1931				
Time	A.M. 10.00	A.M. 11.00	M. 12.00	P.M. 1.00	P.M. 2.00	A.M. 10.00	A.M. 11.00	M. 12.00	P.M. 1.00	P.M. 2.00
Train started 9.30; cooler at 9.47 A. M.						Train and cooler started at 9.00 A.M.				
Outside, wet bulb	65	66	72	76	75	72	75	75	76	77
dry bulb	77	80	82	80	85	80	85	85	90	92
Other car, d.b.	68–70	70–72	72–85	75–80	75–83	82	87	91	92	98
Center test car, w.b.	57	59	62	62	63	60	60	67	64	65
(7 ft. 6 in. up) d.b.	65	67	71	72	73	71	71	78	76	78
Front conditioner, air entering car, w.b.	48	48	55	56	57	57	60	56	55	57
Front conditioner, air entering car, d.b.	52	52	60	60	60	60	63	60	58	60
Front conditioner, air entering cooler, w.b.	58	63	64	65	66	64	65	68	66	67
Front conditioner, air entering cooler, d.b.	63	75	74	76	76	73	74	78	79	79
(Rear conditioner gave closely similar results both days.)										
Level of passengers' head, d.b.										
Left front	70	70	74	76	77	73	73	80	78	80
Left center	67	66	70	73	71	71	71	78	76	78
Left rear	70	70	74	76	77	73	74	80	80	80
Other side closely similar										
Total amp. used	44	47	..	49	55	Ice consumption = 418 lb. per hr.				
Volts	29	30	..	31	30					
Ice consumption = 290 lb. per hr.										

supply a number of spare bottles can be filled in the oil room, carried in a basket or box to the bearings and the empties replaced with full bottles.

The cock in the shank permits shutting off the flow when the bearings are idle, making it unnecessary to remove the wicks to stop the feed. This shut-off feature also conserves the oil supply when machinery is not running. Further, it provides an accumulation of oil to flush the bearing when the cock is opened. After the accumulated oil runs out, the "Glaswick" feeds at the predetermined rate.

Chipping and Riveting Hammers

The Buckeye Portable Tool Company, Dayton, Ohio, has just placed on the market a pneumatic high-speed chipping and light riveting hammer, of which the one-diameter piston is the only moving part. The piston is self-controlled. There are



Hercules high-speed chipping and riveting hammer

no valves or flapper plates, the piston itself performing both the function of a piston and a valve at the same time. The piston in this hammer is balanced, eliminating friction from the cylinder walls. Vibration and recoil have been reduced to a minimum and the hammer throttles down for light blows without jumping or stopping. The hammer has only three major parts—the handle, the cylinder and the piston.

Elwell-Parker Elevator Chisel Truck

The Elwell-Parker Electric Company Cleveland, Ohio, has placed on the market a 6,000-lb. fork-type electric truck

Elwell-Parker electric truck of 6,000 lb. capacity

which is built to accommodate either a battery or gas-electric unit for power purposes. The truck is driven by motor through worm and gear. The drive wheels are 22 in. in diameter. The power plant is supported at three points to accommodate it to uneven runways, shop yards and platforms.

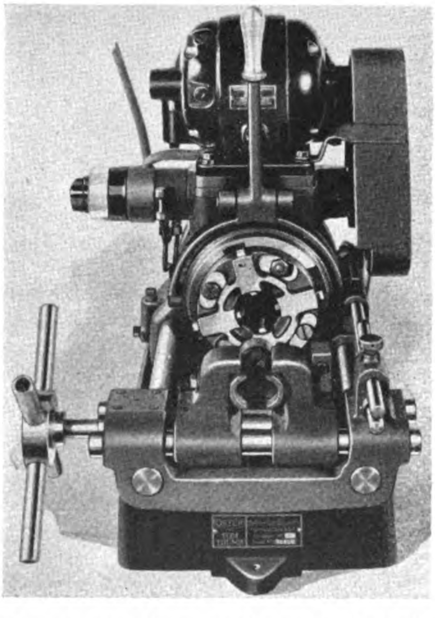
The forks are made in various lengths and with varying spreads to accommodate different types of loads such as sheets, boxed machinery or loaded skids. After the forks are thrust under the load it may be tilted back 30 deg. to facilitate safe carrying to destination where the load may then be elevated for tiering if desired.

Both the tilt and hoist features are accomplished by one unit. The lift is by cable while the positive tilt is by rack and pinion drive. Likewise the rack type provides for a positive forward tilt of uprights of several degrees. Automatic limit switches are used throughout in the operation of the truck.

"Tom Thumb" Machine With Rotary Die Head

As a companion to the original Tom Thumb pipe and bolt machine, which was placed on the market last year, the Oster Manufacturing Company and Williams Tool Corporation, Cleveland, Ohio, have just brought out the new rotary-die-head Tom Thumb.

The regular pipe capacity of the new machine includes all sizes from 1/2 to 1 1/4



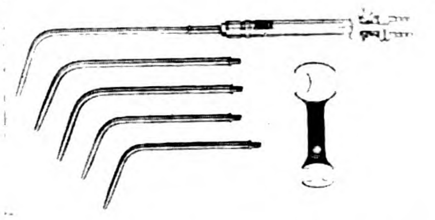
The Oster pipe machine showing the adjustable quick-opening die head and the use of nipple jaws

in. with an extra capacity down to and including 1/8 in. The regular bolt capacity is 3/8 in. to 1 1/4 in. with an extra capacity of 1/4 in., 5/16 in., 1 3/8 in. and 1 1/2 in. It can be furnished either as a bolt threader or with special equipment to handle nipples.

The machine is equipped with a stock-stop and an automatic trip which opens the die head when the thread has reached any desired length. A hand trip is also furnished. Driving power is furnished by the 1/2-hp. Domestic universal reversible motor and is transmitted to the machine by means of the double V-belt drive.

Airco Style 9800 Welding Torch

The Air Reduction Sales Company, New York, has recently placed on the market a new welding torch known as



Airco-Davis-Bournonville Style 9800 welding torch with long flame characteristic

Style 9800. Among the new features embodied in this torch are a ribbed handle, new type mixing-head nut, oxygen and acetylene ball-seat type needle valves and an improved method of repacking the needle valves.

The ribbed handle affords a positive gripping surface without harshness to the hand. A skirt has been added to the hexagonal nut on the mixed head, allowing it to be loosened or tightened by hand and eliminating the necessity of using a wrench. The ball-seat type needle valve has been adopted for this torch after extensive trials. The principal feature of the Airco needle valve is a ball seat of stainless steel.

Among the characteristics of the Style 9800 torch is that of a soft flame which is accomplished by reversing the conventional methods of bringing gases to the tip. In this torch the oxygen enters the torch head at the side and the acetylene through the center. Tips of pure hard-drawn copper of either the swagged or the separable type may be used with this torch. Both types of tips are made to furnish the bulbous or the long pointed flame.

Tools Tipped with Tungsten Carbide

The O. K. Tool Company, Shelton, Conn., has developed a line of cutter blades and tool bits tipped with tungsten carbide which are interchangeable with any of the standard cutters now manufactured by that company. These tools are made in a wide range of shapes and sizes to be used in milling cutters, boring and facing tools and single tool holders. The O. K. face mills with tungsten carbide blades are made in diameters from 4 in. to 14 in., while the end mills range in diameter from 1 1/2 in. to 7 in.

(Turn to next left-hand page)

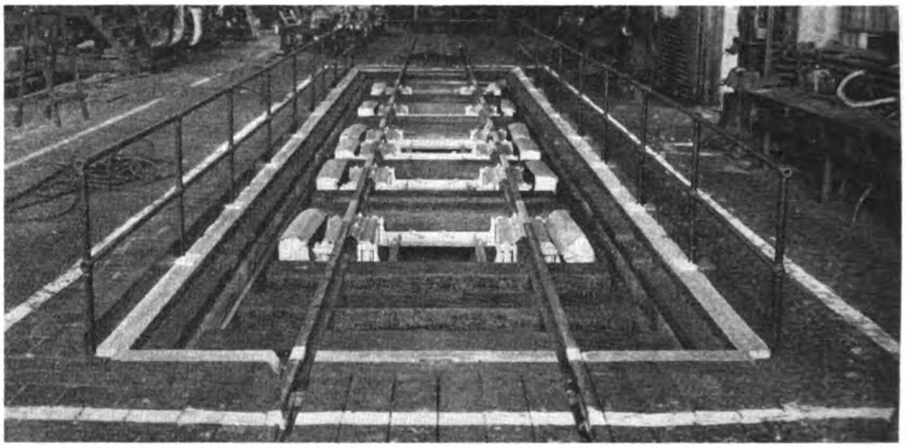
Locomotive Wheel Scales For Checking Rail Loadings

Fairbanks, Morse & Company, 900 South Wabash avenue, Chicago, has installed locomotive wheel scales in the North Billerica, Mass., shops of the Boston & Maine for checking rail loadings and to determine whether or not alterations made to locomotives since being weighed by the builders have changed the distribution of weight over the driving wheels and, perhaps, overloaded certain springs.

The scales are composed of six units, each of which serves one pair of wheels. The units are placed in a concrete pit in the erecting shop, accessible to the traveling cranes used handling locomotives. The load-bearing member of each scale is a section of 100-lb. rail 30 in. long. This length enables the units to be so located that they accommodate a majority of the locomotives without change. The units have to be shifted to provide for the other engines. The shop foreman is furnished a diagram which enables him to relocate the units to suit the wheel spacing required by the locomotive to be weighed. An assortment of rails of odd lengths are kept on hand to serve as fixed rails to connect the scale rails.

One unit of the wheel-load scales

The scales, two of which with their frame constitute a unit, are of 40,000-lb. capacity each, tested to an accuracy of 25 lb. At the ends of each load-bearing member is a post which serves both as a support for one of the main levers and for the adjacent fixed rail, insuring the proper relation between the fixed and the scale rails. The weigh beams, which are of the screw type, are located 18 in. outside the center of the rail and at about the height of its base. The poise has a run of 20 in., with a lead of ½ in., on a triple thread. All parts exposed to water dripping from the engines are of aluminum or are nickel-plated. When not in use, the weighing beams are covered by removable hoods for protection.

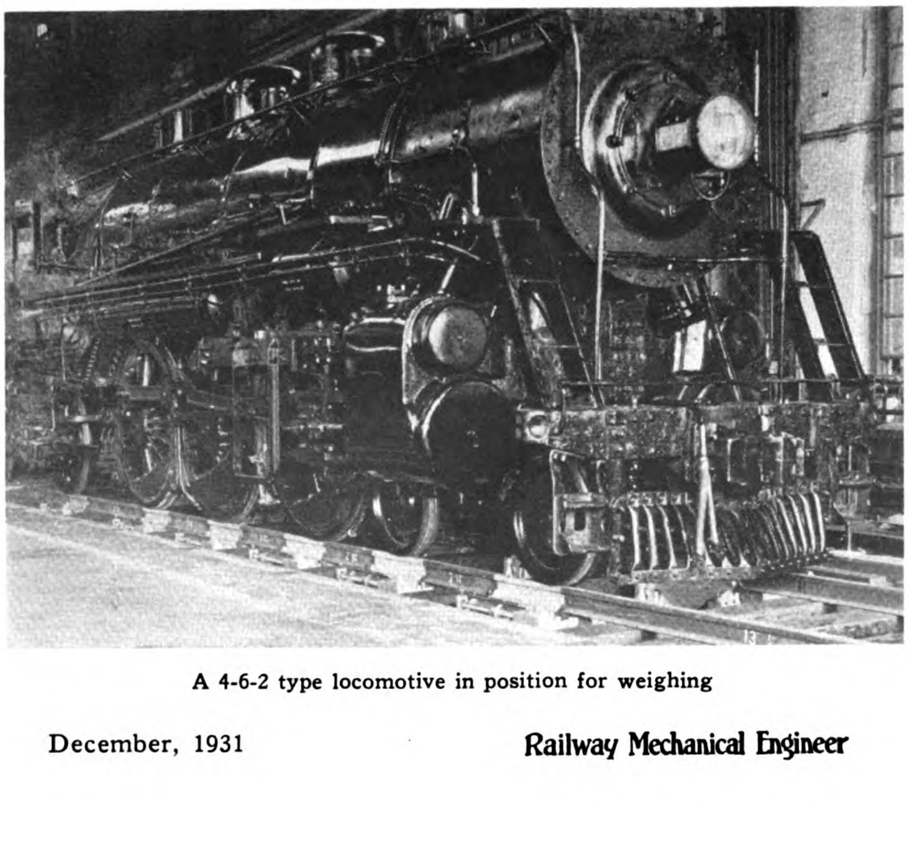


Set of six units of two Fairbanks locomotive wheel-load scales installed in the North Billerica shops of the Boston & Maine—The distance between the units can be adjusted to suit different types of power and rolling stock

The two scales forming a unit are installed on a rectangular, structural-steel frame about 8 ft. long, which extends across the pit. The frame is provided with clevices for convenience in handling the unit with the crane.

A pit 50 ft. long, 10 ft. wide and 16¾ in. deep is provided for this apparatus, the length being sufficient for an additional unit if desired later. In the center of the pit is a longitudinal trench 20 in. deep, running the entire length and communicating with a drain pipe at one end. The thickness of the concrete under the pit on each side of the trench is 3 ft. and under the trench, 20 in. The concrete work, which is reinforced with rods, rests on 34 piles. The floor of the pit on which the units are placed consists of boiler plate.

Individual wheel scales of this arrangement can be used for dining, business, automotive and other special cars which are often heavier on one side than on the other. The scales also provide means for a correct determination of the weight distribution over the springs. In one instance it was desirable to investigate the effect of the rigidity of a car body with respect to weight distribution when the car passes over track in which there is a wind, or warp, as occurs when entering a curve on which the outer rail is elevated. By jacking one corner of the car while the truck at the opposite end stood on the scales this information was satisfactorily obtained. Locomotive tanks can be conveniently calibrated by scales of this design.



A 4-6-2 type locomotive in position for weighing

The Landis Victor Valve-Seat Tap

The Landis Machine Company, Inc., Waynesboro, Pa., has developed and placed on the market a unique tap for tapping the valve-seat ring threads in gate valves. These threads have been a source of trouble to the manufacturers of this type of valve because of the fact that the major diameters of the threads are greater than the port openings. The Victor valve-seat tap is fitted with double-ended chasers, one end for each of the two valve-seat ring threads. Its construction is such that the chasers, when collapsed will clear the port openings.

The chasers are expanded to the cutting position by means of a handle pro-

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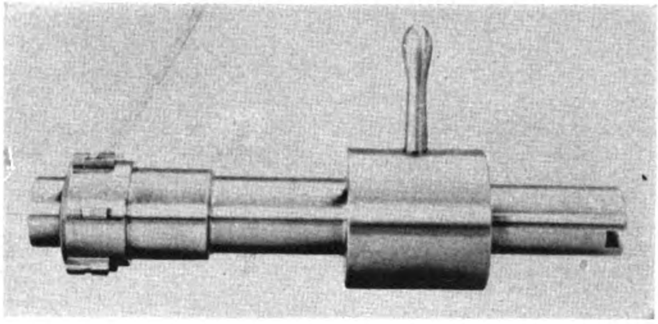


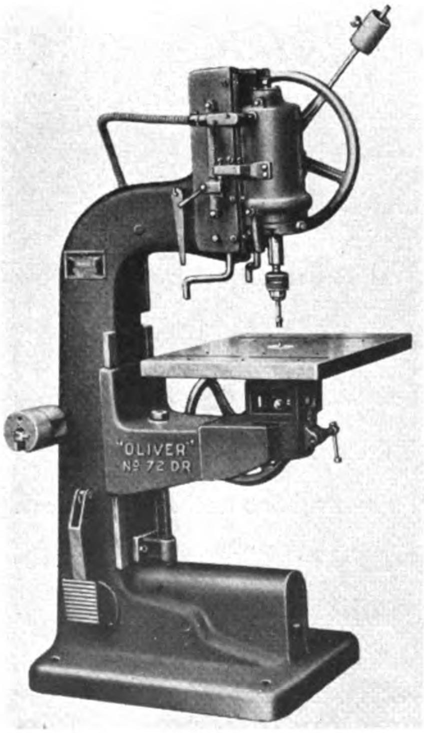
The Victor valve-seat tap fitted with double-end chasers

vided for that purpose after the tap has entered the valve body through one of the port openings. The two threads are tapped with the same chasers in one chucking. The tap is suitable for valves with either parallel or angle seats. Valves with angle seats require a fixture of the trunnion type with stops for bringing the valve-seat ring openings in line with the tap.

Oliver Router For Pattern Makers

The Oliver Machinery Company, Grand Rapids, Mich., has recently developed a router and borer for pattern shop use. This machine, known as the No. 72-DR, will bore holes up to 2 in. in diameter in any depth up to and including 6 in. in the center of 36-in. stock. The table is adjustable 12 in. in a vertical direction, also swivels in a complete circle and can be tilted 35 deg. in all directions. The spindle has a maximum stroke of 6½ in. The size of the table is 20 in. by 24 in. and it is machined on the top and four sides.

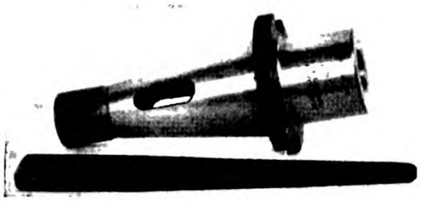
The machine is driven by a 3,600-r.p.m. ball-bearing enclosed motor built into the head and a blower fan with blower pipe leading to the work helps cool the motor and tools as well as to blow the chips away from work.



The Oliver router for pattern-shop use

B. & S. Cutter Adapters

The Brown & Sharpe Manufacturing Company, Providence, R. I., has recently announced new cutter adapters for use with milling machines having a standardized spindle end with No. 40 taper, to accommodate end mills, collets, etc., having No. 3 Morse and No. 7 and No. 9 Brown & Sharpe taper shanks. While at the present time there are few milling machines with No. 40 milling-machine standard taper ends, these adapters anticipate present plans of machine-tool manufacturers to incorporate this taper in machines of small sizes.



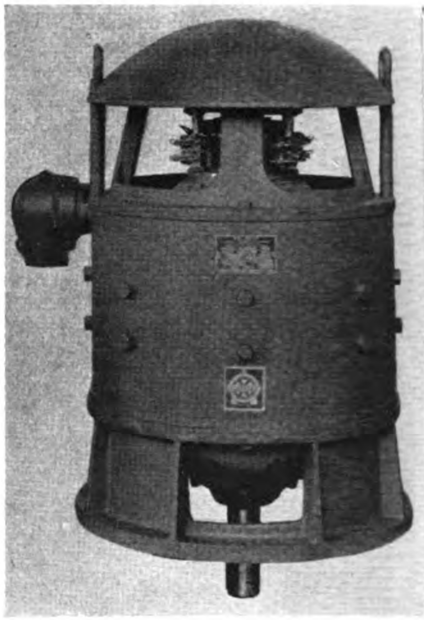
A Brown & Sharpe cutter adapter for standardized milling-machine taper end

These adapters will find a wide range of usefulness among users of milling machines having the standardized spindle end, who may wish to use end mills, collets and other tools having the Morse and Brown & Sharpe tapers mentioned above.

Direct-Current Vertical Motors

The Reliance Electric & Engineering Company, Cleveland, Ohio, has developed a line of direct-current motors for vertical operation in sizes up to 50 hp., 1,150 r.p.m. These motors are provided with a ring base for mounting and a drip cover to protect them from falling dirt and chips and from dripping water, oil or other injurious solutions.

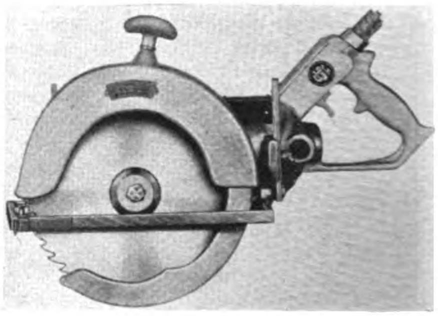
Where it is desirable, the motor can be mounted directly on the machine being driven without the ring base and appear as an integral part of the machine. Amply large bearings are used to take up the thrust load or weight of the armature. Two heavy eye-bolts are provided to make handling easy. In all other ways the construction is the same as the Reliance Type T, direct-current, heavy-duty motor for horizontal operation.



Reliance Type T motor for vertical operation

U. S. Portable Electric Saw

A portable electric hand saw has been recently placed on the market by the United States Electrical Tool Company, Cincinnati, Ohio. This saw is designed to cut wood, stone, slate and other materials and has ample power to saw the hardest wood, wet or dry. Only two adjustments are necessary to set this saw instantly for any depth and for any angle up to 60 deg. A patented beveling device does away with the need for a try-square. A clear-vision blower keeps the sawdust away from the markings so that it is easy to saw evenly. Top guard and automatic bottom guard protect the operator in all working positions. Ball bearings are used throughout on all models of this saw. It is made for depths of 1⅞, 2⅝, 3 1/16, 3 9/16 and 4⅛ in. The weight is 26¼ lb.



Portable saw manufactured by the U. S. Electrical Tool Company

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Among the Clubs and Associations

Toronto Railway Club.—The annual dinner of the Toronto Railway Club will be held at 7 p. m. on December 12 at the Royal York Hotel, Toronto, when an address on "Disarmament" will be presented by Lt. Col. Geo. Drew, commissioner, Security Frauds Prevention Board. This will take the place of the regular meeting.

Canadian Railway Club.—A. M. Candee, general engineer of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., will present a paper entitled "Modern Practice in Arc Welding, Design and Construction" at the meeting of the Canadian Railway Club which will be held at 8 p. m. on December 14 at the Windsor Hotel, Montreal. Slides will be used to illustrate the paper.

Northwest Car Men's Association.—A new organization, known as the Northwest Car Men's Association, has recently been organized in the Twin Cities, Minn., with the objectives of improving the acquaintance of car-department supervisors and inspectors in that territory, promoting a better understanding of the rules of interchange and mutual problems in that connection; and contributing to railway economy and better service. At the first meeting, held November 16, 300 new members were taken into this association, and it is anticipated that at least 200 more will be secured within the next few months. It is especially the purpose of the association to work in close co-ordination with other similar associations, rather than to compete with them. ¶At the first meeting of the association, which was addressed by E. J. Robertson, superintendent of the car department, Soo Line, the following officers were elected: President, F. J. Swanson, general car-department supervisor, Chicago, Milwaukee, St. Paul & Pacific, Minneapolis, Minn.; first vice-president, J. M. Ryan, assistant master car builder, Chicago, St. Paul, Minneapolis & Omaha, Hudson, Wis.; second vice-president, G. J. Conklin, foreman of inspectors, Minneapolis, St. Paul & Sault Ste. Marie, Minneapolis; treasurer, F. S. Leavitt, auditor, Minnesota Transfer Railway, St. Paul, Minn.; secretary, E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul. Meetings are to be held at 8 p.m. the third Monday of each month, with the exception of June, July and August, at the Minneasota Transfer Y. M. C. A. Gymnasium building, St. Paul.

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

Air-Brake Association.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

Allied Railway Supply Association.—F. W. Venton, Crane Company, Chicago.

American Railway Association.—Division V. —Mechanical.—V. R. Hawthorne, 59 East Van Buren street, Chicago.

Division V.—Equipment Painting Section.—V. R. Hawthorne, Chicago.

Division VI.—Purchases and Stores.—W. J. Farrell, 30 Vesey street, New York.

Division I. — Safety Section. — J. C. Caviston, 30 Vesey street, New York.

Division VIII.—Car Service Division.—C. A. Buch, Seventeenth and H. streets, Washington, D. C.

American Railway Tool Foremen's Association.—G. G. Macina, 11402 Calumet avenue, Chicago.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.

Railroad Division.—Paul D. Mallay, chief engineer, transportation department, Johns-Manville Corporation, 292 Madison avenue, New York.

Machine Shop Practice Division. — Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.

Materials Handling Division.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.

Oil and Gas Power Division.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.

Fuels Division.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

American Society for Steel Treating.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

American Society for Testing Materials.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa.

American Welding Society.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

Association of Railway Electrical Engineers. —Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

Canadian Railway Club.—C. R. Crook, 2276 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month except in June, July and August, at Windsor Hotel, Montreal, Que.

Car Department Officers Association.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

Car Foremen's Association of Chicago.—G. K. Oliver, 2514 West Fifty-Fifth street, Chicago. Regular meeting, second Monday in each month except June, July and August, Great Northern Hotel, Chicago, Ill.

Car Foremen's Club of Los Angeles.—J. W. Krause, 608 South Main street, Los Angeles, Cal. Meetings second Monday of each month except July, August and September, in the Pacific Electric Club building, Los Angeles, Cal.

Car Foremen's Association of Omaha, Council Bluffs and South Omaha Interchange.—Geo. Kriegler, car foreman, Chicago, Burlington & Quincy, Sixteenth avenue and Sixth streets, Council Bluffs, Iowa. Regular meetings, second Thursday of each month at Council Bluffs.

Car Foremen's Association of St. Louis.—F. G. Weigman, 720 North Twenty-third street, East St. Louis, Ill. Regular meeting first Tuesday in each month, except July and August, at American Hotel Annex, St. Louis, Mo.

Central Railway Club of Buffalo.—T. J. O'Donnell, executive secretary, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meeting, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

Cincinnati Railway Club.—D. R. Boyd, 453 East Sixth street, Cincinnati. Regular meeting second Tuesday, February, May, September and November.

Cleveland Railway Club.—F. L. Frericks, 14416 Alder avenue, Cleveland, Ohio. Meeting second Monday each month, except June, July and August, at the Auditorium, Brotherhood of Railroad Trainmen's building, West Ninth and Superior avenue, Cleveland.

Eastern Car Foremen's Association.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings fourth Friday of each month, except June, July, August and September.

Indianapolis Car Inspection Association.—P. M. Pursian, 823 Big Four building, Indianapolis, Ind. Regular meetings first Monday of each month at Hotel Severin, Indianapolis, at 7 p.m. Noon-day luncheon 12:15 p.m. for Executive Committee and men interested in the car department.

International Railroad Master Blacksmith's Association.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

International Railway Fuel Association.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago.

International Railway General Foremen's Association.—William Hall, 1061 W. Wabash street, Winona, Minn.

Louisiana Car Department Association.—L. Brownlee, 3730 South Prieur street, New Orleans, La. Meetings third Thursday.

Master Boilermakers' Association. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

Master Car Builders' and Supervisors' Association.—See Car Department Officers Association.

National Safety Council—Steam Railroad Section.—W. A. Booth, Canadian National Montreal, Que. William Penn and Fort Pitt Hotels, Pittsburgh, Pa.

New England Railroad Club.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting, second Tuesday in each month, excepting June, July, August and September. Copley-Plaza Hotel, Boston.

New York Railroad Club.—Douglas I. McKay, executive secretary, 26 Cortlandt street, New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York.

Northwest Car Men's Association.—E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meeting third Monday each month, except June, July, and August, at Minnesota Transfer Y. M. C. A. Gymnasium building, St. Paul.

Pacific Railway Club.—W. S. Wollner, P. O. Box, 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

Pueblo Car Men's Association.—I. F. Wharton, chief clerk, Interchange Bureau, Pueblo, Colo.

Railway Business Association. — Frank W. Noxon, 1124 Woodward building, Washington, D. C.

Railway Car Men's Club of Peoria and Pekin.—C. L. Roberts, chief clerk, Peoria & Pekin Union Railway, 217 Lydia avenue, Peoria, Ill.

Railway Club of Pittsburgh.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August, Ft. Pitt Hotel, Pittsburgh, Pa.

Railway Fire Protection Association.—R. R. Hackett. Baltimore & Ohio, Baltimore, Md.

Railway Supply Manufacturers' Association. —J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

St. Louis Railway Club.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

Southern and Southwestern Railway Club.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, July, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

Supply Men's Association. — E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division American Railway Association.

Toronto Railway Club.—J. A. Murphy, 1405 Canadian National Express building, Toronto 2, Ont. Meetings third Monday of each month, except June, July and August.

Traveling Engineers' Association. — W. O. Thompson, 1177 East Ninety-eight street, Cleveland, Ohio.

Western Railway Club.—J. H. Nash, 343 South Dearborn street, Chicago. Regular meetings, third Monday in each month.

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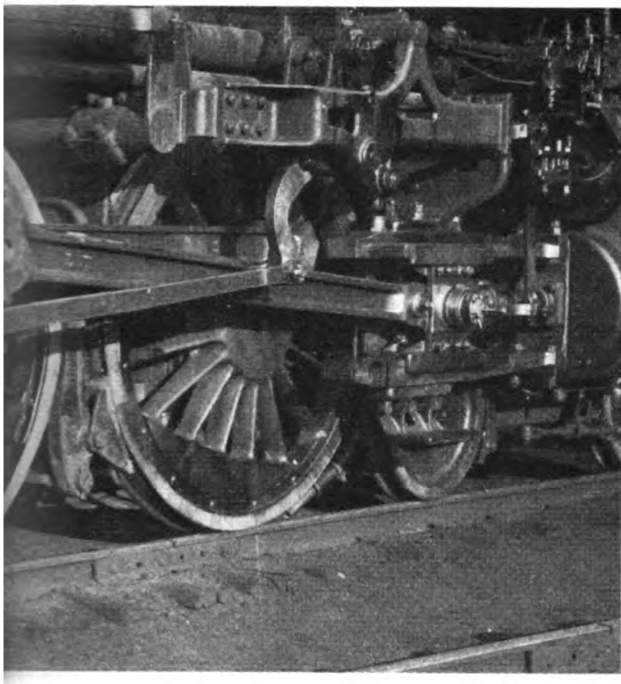


QUALITY *Always*

O FORGINGS

Add Dependability to the Business End of the Locomotive

WITH piston thrusts on modern locomotives ranging around 175,000 lb., the responsibility of transmitting this tremendous power rests entirely upon the structural stamina of the piston rods, guides, side rods, crank pins and axles. They must not fail. In fact, it is their dependable performance that has made possible the modern locomotive with its big drawbar pull at high freight and passenger speeds.

Only quality forgings, with that extra measure of dependability can stand up under the terrific stresses of hard service. ALCO Forgings are just that kind—quality all ways—quality always. Back of every ALCO Forging stands years of forging experience, metallurgical research and scientific manufacturing methods. As locomotive builders there is that spirit of responsibility—that constant urge to produce superior forgings which enhance the dependability and efficiency of the assembled locomotive.

ALCO standards are high—always have been—always will be. Only the finest raw materials are used in ALCO Forgings. All billets are tested for chemical properties and physical soundness. They are properly pre-heated before forging and later heat-treated to insure the best in grain refinement and the highest ductility with the desired tensile strength.

To entrust ALCO with the manufacture of all your locomotive forgings is to guarantee dependability to the business end of your locomotives and big economies for your railroad.

American Locomotive Company

30 Church Street New York N.Y.

NEWS

THE NEW YORK CENTRAL has opened negotiations with its unionized workers with the object of having them accept a 10 per cent reduction in wages for a period of one year. The announcement, issued on October 30, said that "confirmation was given today at the executive offices of the New York Central Railroad to reports that representatives of the various classes of the system's employes are engaged in discussions with a view to the entire personnel voluntarily taking a 10 per cent pay reduction for one year."

C. P. R. Re-opens Shops

EIGHT THOUSAND railway workers in six provinces in Canada returned to work November 17, when the Canadian Pacific reopened its principal shops which were closed in September as a measure of economy.

In Angus Shops, Montreal, 4,500 have returned to work, while the remaining 3,500 workers are distributed over the following shops; McAdam Junction, N. B., Carleton Place, Ont., West Toronto, Ont., North Bay, Ont., Weston Shops, Winnipeg; Ogden Shops, Calgary, and Vancouver shops.

experimental installation, and the Southern made favorable response to this suggestion.

The apparatus is described in a recent issue of the Railway Gazette (London). This line where the system was tried is operated by the manual block system and the locomotive is fitted with the automatic vacuum brake. Inductors fixed on the ties between the rails have magnetic effect on a receiver fixed on the locomotive in front of the leading axle, and an armature of this receiver, when moved, acts on the vacuum pipe of the brake system.

The system includes a speed control arrangement, but this has not yet been put in use. With this, actuated by an axle of the locomotive, it is proposed to prevent the use of the acknowledger (which is substantially a forestaller), except when the speed of the train is less than 25 m.p.h.

This system is to be tried on the London, Midland & Scottish, in Derbyshire.

Centenary of the John Bull

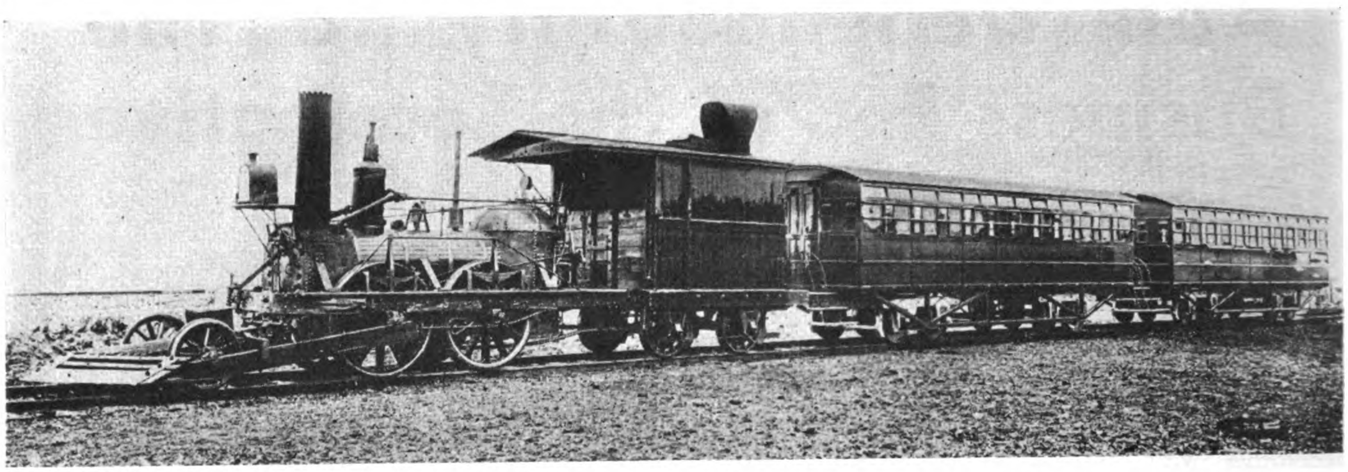
THE OLD PENNSYLVANIA Railroad locomotive "John Bull," the first locomotive to run in the state of New Jersey, which for many years has been in retirement at the Smithsonian Institution at Washington, during November celebrated the centenary of its first use, which was on November 12, 1831. The engine, with its tender and one passenger car, is now on display in the Hall of Transportation of the Institution. It has been jacked up off the ancient rails on which it stands so that the wheels can be revolved, compressed air, not steam, being used as the motive power.

This engine arrived from England in August, 1831, and two months later was used to haul the first passenger train over the Camden & Amboy, now a part of the Pennsylvania system. There was, however, no regular steam service for about two years, horses being used until 1833.

The exhibition includes an elaborate series of photographs within the passenger car; and, on a pedestal near the train, a replica of the monument at Bordentown, N. J., which marks the location of the first piece of track laid on the Camden & Amboy.

In 1893, the John Bull was run from Jersey City to Chicago, under its own steam, for exhibition at the Columbian Exposition. The picture of the locomotive, tender and two 8-wheel cars, printed herewith, shows the train as it appeared in that year. The pilot, with its two wheels, and the tender, were additions made some time subsequent to 1831.

The cars, as re-conditioned in 1893, were said to appear substantially as they did when built, though they had new seats, and new wheels and axles.



The John Bull and its train

First locomotive operated in New Jersey. Engine, tender and cars reconditioned in 1893.

Railway Executives Hold Conference with Labor Leaders

REPRESENTATIVES of railway labor organizations, headed by D. B. Robertson, president of the Brotherhood of Locomotive Firemen & Enginemen and chairman of the Railway Labor Executives' Association, met with a committee of railway presidents, headed by Daniel Willard, president of the Baltimore & Ohio, in New York on November 19, for the purpose of discussing matters of mutual interest.

The meeting resulted from the acceptance by railway presidents of the Railway Labor Executives' Association suggestion that a joint conference be arranged to discuss "any proposal affecting railway operation which railway managements desire to advance" and "any proposals, including present and future relief of unemployment and stabilization of employment" which the labor organizations desire to advance.

Announcement that the invitation had been accepted was made in a statement issued by Mr. Willard following a meeting of the Association of Railway Execu-

(Continued on next left-hand page)

Strowger-Hudd Automatic Train Control

ON THE SOUTHERN RAILWAY of England, at Byfleet, there has been in regular use since March last, on the locomotive "Sir Gaheris," the Strowger-Hudd system of automatic train control, the proprietor of which is "Automatic Electric, Inc." of Chicago; but all the apparatus for which is said to be British made. This system was noticed in the report of the British Automatic Train Control Committee dated November 3, 1930, but without any formal commendation, the apparatus not having been tried. The government committee suggested that some road should make an

The MARK of EXTRA SERVICE

STAMPED on Carnegie Wrought Steel Wheels, the initials "R T" (Rim Toughened) identify wheels particularly adapted to modern heavy-duty service—wheels that will give you greater service, greater safety, greater economy. These initials indicate the additional refinement of heat treatment, the process of which produces a wheel with an especially tough rim and with high physical properties—a wheel that has been demanded by, and made especially for the ever-increasing weight and speed of modern transportation. Accurate machining insures perfect rotundity with a consequent increase in riding comfort.

Carnegie Rim-Toughened Wrought Steel Wheels are furnished for passenger, engine truck and tender service. Carnegie Light Weight Freight Car Wheels, rim-toughened, are also available for 70-ton freight service.

The outstanding advantages of wrought steel are well known. Let our wheel engineers bring you complete details of this further improvement. Carnegie Rim-Toughened Wrought Steel Wheels have created a new standard of service and value.

CARNEGIE STEEL COMPANY **PITTSBURGH, PENNA.**

Subsidiary of United States Steel Corporation 154

CARNEGIE WROUGHT STEEL WHEELS

tives at New York City on November 13.

The following are the salient features of the program made public by the Railway Labor Executives' Association:

"A definite number of employees should be assured permanent employment and auxiliary forces should be assured part-time employment, thus ending the feeling of insecurity on the part of a large proportion of railroad workers.

"Creation of a mobile force of extra workers, shifting from road to road, as rolling stock is now shifted to meet traffic requirements. Through co-ordinated effort of managements and labor, average earnings per employee could be raised without a wage increase and labor efficiency would be augmented.

"Motor transport should be required to observe the same principles of safe, efficient and socially just operation as are required of the railways. Railway employees displaced by motor transport should be given the opportunity to enter that field.

"The working day should be shortened and reductions in working force should be brought about by employing fewer new men and reducing hours of labor.

"The principal wage-lowering factor in railroad work is part-time employment. Stabilization would remedy this evil.

"There should be provision for a payment on dismissal to all experienced employees discharged. There should be federal legislation providing for pensions and workmen's compensation.

"There should be set up pay roll reserves to maintain employees' compensation during depression."

The following immediate measures were proposed:

"Insuring one year's employment to the necessary employees in each class, thus freeing 1,250,000 workers from the fear of unemployment and increasing the purchasing power of a $2,000,000,000 pay roll.

"Creation of a joint commission to study ways and means of applying the six-hour day to the different classes of employees.

"Joint action to promote a $1,000,000,000 federal bond issue for grade crossing elimination; to regulate highway transport and find jobs in it for furloughed railroad employees; to protect the interests of all in consolidation; to promote federal pension and compensation insurance legislation; to establish an emergency employment bureau; and to coordinate train crews and train lengths 'on the basis of economical, safe operation.'"

Supply Trade Notes

A. A. PROBECK has been appointed sales manager of the Federal Machine & Welder Company, Warren, Ohio.

GEORGE H. MALONY has been elected secretary of Whitman & Barnes, Inc., Detroit, Mich., to succeed J. I. Holton, resigned.

WILLIAM P. WITHEROW, vice-president of the Republic Steel Corporation, has resigned to devote his time to private interests.

J. B. BERRYMAN, first vice-president of the Crane Company, Chicago, has been elected president to succeed R. T. Crane, Jr., deceased.

CLINTON S. DOW, member of the firm of Greer, Crane & Webb, New York, has been elected president of the Ardco Manufacturing Company, Hoboken, N. J., to succeed H. Otto Wittpenn, deceased.

HARRY L. ERLICHER, assistant purchasing agent of the General Electric Company, Schenectady, N. Y., has been appointed purchasing agent, succeeding L. G. Banker, retired.

BOYD FISHER has been appointed general manager of the National Machine Tool Builders' Association, Cincinnati, Ohio, succeeding Ernest F. DuBrul, resigned.

THE PAGE STEEL & WIRE COMPANY, Bridgeport, Conn., has opened a southeastern district sales office at 1520 Healey building, Atlanta, Ga. R. J. Teeple has been placed in charge.

L. W. ERICKSON has been appointed district representative for the Milwaukee and Wisconsin territory of the Foote Brothers Gear & Machine Company, Chicago, to succeed E. L. Parsons.

THE CHICAGO PNEUMATIC TOOL COMPANY, New York, has moved its offices and service station at Seattle, Wash., from 1743 to 3201 First Avenue, South, and C. Kirk Hillman has been appointed district manager.

EDWARD C. KENYON, representative, at Chicago, of the Ashton Valve Company, Cambridge, Boston, Mass., has been appointed Pacific Coast representative with headquarters at San Francisco, Cal., in charge of sales of the railroad and industrial departments.

RALPH W. PAYNE has been appointed district railroad representative in the southeastern states, with office at 613 Fifteenth street, N. W., Washington, D. C., of the American Hoist & Derrick Company, St. Paul, Minn.

CHATARD & NORRIS, 218 Water street, Baltimore, Md., have been appointed exclusive representatives for the eastern part of Maryland and the District of Columbia, of the Homestead Valve Manufacturing Company, Inc., Coraopolis, Pa.

FRANK W. BLAKE, formerly in the railroad machine tool department of Manning, Maxwell & Moore, Inc., and its successor, the Dean Machinery Company, has been appointed general sales manager of the A & E Company, Chicago.

JOHN A. ROCHE, representative of the Syntron Company, Pittsburgh, Pa., has been appointed district representative for the Chicago territory, with headquarters at 1419 Buckingham building, 59 East Van Buren street, Chicago.

A. W. THOMPSON, vice-president and Pacific Coast manager in charge of sales of Fairbanks Morse & Co., with headquarters at San Francisco, Cal., has been elected vice-president in charge of manufacturing, with headquarters at Beloit, Wis., to succeed W. B. Heath, resigned.

THE RAILROAD SUPPLY COMPANY, Chicago, filed a voluntary petition in bankruptcy on October 27, and on the same day the Federal Court appointed Fred E. Hummel, 105 W. Adams street, Chicago, receiver. The receiver has announced that he will continue to operate the business, filling all orders for repairs and new supplies.

F. A. KEIHN, who has been sales engineer, automotive car division, of the J. G. Brill Company, Philadelphia, Pa. since 1924, has been appointed sales engineer of the company and is now in charge of all sales engineering matters. He reports to Charles O. Guernsey, recently appointed chief engineer in charge of all Brill engineering activities.

THE RAILROAD MATERIALS CORPORATION, 30 Church street, New York, has been organized by H. M. Buck as president and A. H. Smith as vice-president. Mr. Buck was formerly vice-president and Mr. Smith was formerly sales representative of the Railroad Supply Company, with headquarters at New York. The new organization will act as sales representatives of manufacturers of railway supplies.

H. W. KILKENNY, St. Louis, Mo., branch office manager of the Ohio Brass Company, Mansfield, Ohio, has resigned. Mr. Kilkenny, who has been actively identified with the electrical industry since 1907, is financially interested in his brother's company, the J. G. Kilkenny Company, manufacturers agents, Cleveland, Ohio.

(Turn to next left-hand page)

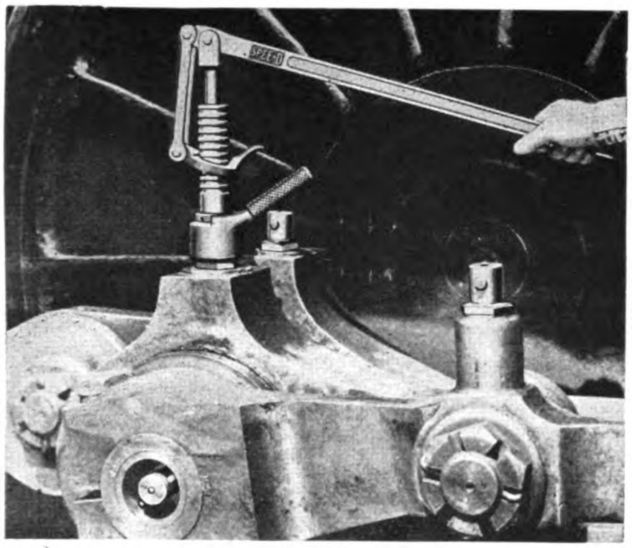
Domestic Orders Reported During November, 1931

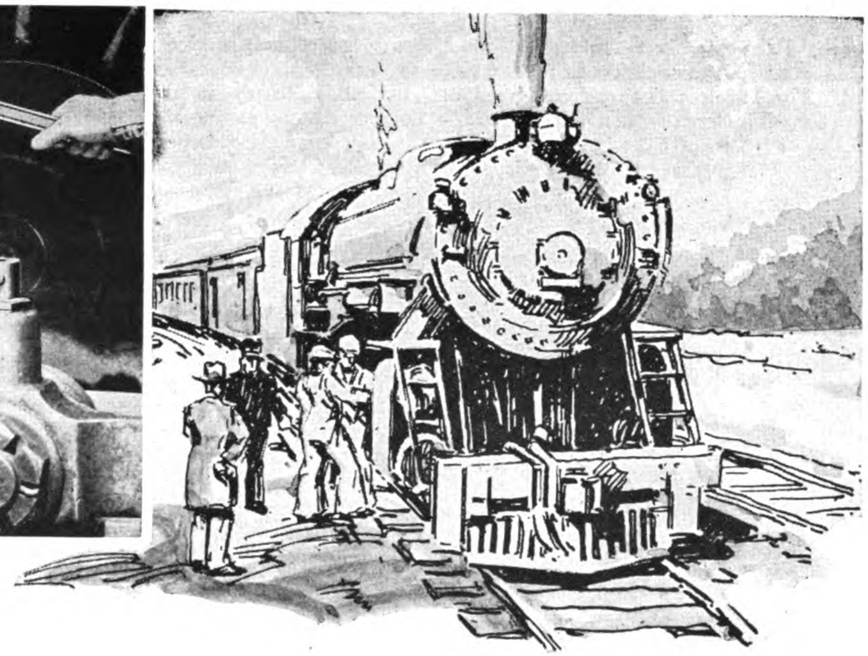
Locomotives

Name of Company	Number Ordered	Type	Builder
Lehigh Valley	10	4-8-4	American Loco. Co.
	10	4-8-4	Baldwin Loco. Works
Total for month	20		

Freight Cars

Name of Company	Number Ordered	Type	Builder
U. S. Navy Department	3	Flat	Haffner-Thrall Car Co. (Chicago)
Boston & Maine	25	Caboose	Company shops (Concord, N. H.)
Total for month	28		





"No More Failures
Due to hot pins or cut bushings"

THIS statement was recently made by a Master Mechanic in charge of a large engine terminal which handles over one hundred locomotives every day.

"Since standardizing on the 'SPEE-D' method of rod cup lubrication" he continued, "rod bearings no longer give us any trouble."

"This is due to the fact that the 'SPEE D' method insures clean lubrication as well as thorough lubrication. No cinders, sand or other gritty materials can get by the ball check of a 'SPEE D' Filler Neck providing the grease itself is clean."

In addition to the savings in rod bearing maintenance this terminal has reduced its engine preparation costs at least one hundred dollars per locomotive per year.

Worth While, is it Not?

RELIANCE MACHINE & STAMPING WORKS, Inc.

NEW ORLEANS, LA.

Agents and Representatives

H. C. MANCHESTER, 3736 Grand Central Terminal, New York City
A. L. DIXON, 325 W. Ohio St., Chicago
CONSOLIDATED EQUIPMENT COMPANY, Montreal
MUMFORD MEDLAND, LTD., Winnipeg
INTERNATIONAL RAILWAY SUPPLY COMPANY, 30 Church St., New York City

Trade Mark Registered

Saves Time, Labor, Grease and Grease Plugs

THE BUSINESS and good will of the McConway & Torley Company of Pittsburgh, Pa., have been sold to Donald Symington and associates of Baltimore, Md. The business is to be continued in Pittsburgh under the name of the McConway & Torley Corporation, with no material changes in existing personnel.

W. J. WIGNALL, formerly vice-president of the Locomotive Terminal Improvement Company, has been appointed director of railroad sales for the A. M. Byers Company, with headquarters at Pittsburgh, Pa.; J. H. Ainsworth is assistant to Mr. Wignall and railroad department representation will be maintained in New York by C. W. Damberg, in Chicago by F. W. Stubbs and in Pittsburgh by C. A. Croft.

W. J. Wignall

Mr. Wignall graduated from Armour Institute of Technology in 1920, his education having been interrupted in 1917 when he enlisted in the United States Army and served overseas in the 127th Engineers until August, 1919. Upon graduation, he became resident engineer in charge of construction for G. L. Clausen, consulting engineer, which position he held until 1922. From the latter date until 1925, he was in the employ of the National Boiler Washing Company, holding positions of construction foreman, assistant to the vice-president in charge of purchases and sales engineer. In 1925, he joined the Locomotive Terminal Improvement Company, serving as sales engineer and later as vice-president, in which capacity he recently resigned. During part of this period, he also held the position of vice-president and director of Railway Hydraulic Systems, Inc.

C. L. SCHNEIDER, who, for the past 14 years, has been connected with the Fruehauf Trailer Company, Inc., Detroit, Mich., serving in various departments, including engineering and sales, has been appointed manager of the company's branch at Chicago, formerly located at 2711 S. Wabash avenue, and now at Michigan avenue and Twenty-ninth street. Frank L. Tully, who has been with the company since 1926, has been appointed manager of the branch at Cleveland, Ohio. He succeeds Harry S. Moore, for many years Cleveland branch manager, who has been promoted and will devote all his time to a special sales assignment.

THE HOPKINS-BENEDICT COMPANY, Chicago, has taken over the distribution, factory sales and service of the Portable Power Tool Corporation, Warsaw, Ind., for all railroads in the United States. Harry D. Stops has been elected vice-president and treasurer and A. C. Thom has been appointed sales and service engineer of the former company.

G. B. ALLISON has opened an office at 50 Church street, New York, as manufacturer's agent. He is representing the Excel Curtain Company, Inc., and solicits accounts of other supply companies. Mr. Allison was formerly district sales manager at New York of the Curtain Supply Company, for eight years, and for the past three years served in the same capacity with the O. M. Edwards Company, Inc.

CHARLES A. LIDDLE, president of the Pullman Car & Manufacturing Corporation, Chicago, has been elected also president of the Standard Steel Car Corporation, a subsidiary of Pullman, Inc., to succeed Patrick H. Joyce, who has been elected chairman of the board of the Standard Steel Car Corporation, as a result of his election as president of the Chicago Great Western. The selection of Mr. Liddle as president of the Standard Steel Car Corporation follows his completion of 31 years in the car building industry, of which 15 have been with the

Charles A. Liddle

Haskell & Barker Car Company and its successor, the Pullman Car & Manufacturing Corporation. His association with Pullman Car includes the period of the company's greatest development. On June 18, 1924, the Pullman Car & Manufacturing Corporation was incorporated to take over all the property, assets and business of the manufacturing department of the Pullman Company, which had manufactured railway equipment since 1867. The facilities acquired also include the properties of the Haskell & Barker Car Company which the Pullman Company absorbed in 1921. This expansion was extended in January, 1930, when Pullman, Inc., acquired the Standard Steel Car Company, and the Osgood-Bradley Car Company, which it has since operated as a group, the Standard Steel Car Corporation, separately from the properties of the subsidiary, the Pullman Car & Manufacturing Corporation. In the same year, the Pullman-Standard Car Export Corporation was organized to take over the Middletown Car Company and to handle the export business of the manufacturing subsidiaries of Pullman, Inc.

Mr. Liddle was born in Philadelphia, Pa., and was educated at the Central Manual Training School, Philadelphia, and Drexel Institute. He entered business as an employee of the Allison Manufacturing Company at Philadelphia, and later served the Jackson & Sharpe Company and the Harlen & Hollingsworth Company at Wilmington, Del., and the Pressed Steel Car Company at Allegheny, Pa. In 1901 he entered the employ of the American Car & Foundry Company as an engineer, later being promoted to assistant to the vice-president and then to general manager. On January 1, 1916, he resigned to become vice-president of the Haskell & Barker Car Company, Michigan City, Ind., which position he held until January 14, 1922, when the company was absorbed by the Pullman Company and he was elected vice-president of the latter company. In 1924 he was made vice-president of the Pullman Car & Manufacturing Corporation and in November, 1928, president of the latter company.

ROBERT S. BINKERD, formerly vice-chairman of the Eastern Railroads' Committee on Public Relations, who has been appointed director of sales of the Baldwin Locomotive Works, with headquarters at Philadelphia, Pa., was born on November 7, 1882, at Dayton, Ohio, and was graduated from Yale University in 1904. He then served for four years as secretary of the Municipal Voters' League at Buffalo, N. Y. In 1908 and 1909 he was secretary of the Citizens' Union in New York and served in the same capacity with the City Club of New York from 1909 to 1917. During the latter year he became advisor to the Fusion Committee in the

Robert S. Binkerd

New York City municipal election, and later in the same year, joined the organization of the Association of Railway Executives in New York as assistant to the chairman, in which capacity he was closely identified with the association's public relations work. In 1922 he was appointed vice-chairman of the Committee on Public Relations of the Eastern Railroads and resigned in September, 1927, to become

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a general partner in the New York stock exchange firm of James H. Oliphant & Co. Mr. Binkerd later forsook this connection, but has continued up to the present his active association with financial enterprises in New York.

The Wright Manufacturing Company, Bridgeport, Conn., has moved its general sales office from that city to York, Pa.

James C. Younglove, general sales manager of the Western division, transportation and government department, of the Johns-Manville Corporation, New York, with headquarters in Chicago, has resigned to become general manager of the transportation and government division of the American Hair & Felt Company and the Dry-Zero Corporation, with headquarters in the Merchandise Mart at Chicago. The appointment of Mr. Younglove, who will continue to specialize in insulations for the transportation field, follows the establishment by these two companies of their own direct sales organization for the purpose of marketing their products in the railroad and general transportation fields. Heretofore, this has been done through a sales agency. Mr. Younglove was born on August 7, 1879, at Crescent, Saratoga County, N. Y., and attended Armour Institute of Technology at Chicago. After spending several years with the National Lead Company, he joined with J. E. Meek in organizing the railroad department of the Johns-Manville Corporation, with which company he has been identified for nearly 30 years. For a period of several years he was a director of the company.

Obituary

C. Hastings, retired vice-president of the Locomotive Finished Material Company, Atchison, Kan., died on November 17.

Albert Jefferson Sayers, an engineer of the Link-Belt Company, Chicago, died at his home in Chicago, on October 11, at the age of 61.

A. H. Darker, chief electrical engineer for J. Stone & Co., Ltd., London, England, died on November 15, at Brisbane, Australia, where he was visiting. During his career of over 30 years with this company Mr. Darker had made many trips around the world in connection with the Stone system of car lighting.

Richard T. Crane, Jr., president of the Crane Company, Chicago, died on November 7 in New York after an illness of 10 days. Mr. Crane was born in Chicago, on November 7, 1873, and graduated from the Sheffield Scientific School of Yale University in 1895. In the following year he entered the employ of the Crane Company, which was founded in 1855 by his father, and after a year spent in the foundries, entered the office in the city sales department. In 1898 he was elected second vice-president, which position he held until 1914, when he was elected president.

Edward E. Gold, inventor of a car heating system now in use on many railroads in the United States, Canada and Europe, died of a heart attack at his home in New York on October 30, at the age of 84. Mr. Gold was born at Waverly, Ill., and was educated in a private school at

Edward E. Gold

Washington, Conn. At the age of 18 he entered the employ of the Scovill Manufacturing Company, New York. In 1882 he invented the system for heating railroad cars with steam from the locomotive by means of a steam hose coupler. Mr. Gold had obtained more than 100 American and foreign patents. After the railroads began using electricity as motive power, especially on suburban trains, Mr. Gold developed an electric heater for railroad use. Soon after inventing his steam-heating system, Mr. Gold organized the Gold Car Heating Company which was reorganized on account of expansion of business in 1903 as the Gold Car Heating & Lighting Company, of which Mr. Gold was president until three years ago when he resigned to become chairman of the board. He maintained an active interest in the business until the time of his death.

Charles L. Heisler of the engineering general department of the General Electric Company, Schenectady, N. Y., died at his summer home at Rock City Falls, near Saratoga, N. Y., on October 13. Mr. Heisler was born on February 22, 1863, at Wapakoneta, Ohio, and was graduated from Cornell University in 1890, with the degree of M. E. Mr. Heisler first served with the Brooks Locomotive Works, Dunkirk, N. Y., and subsequently with the Dunkirk Engineering Company. While with the latter organization he developed the Heisler type of geared locomotive, the manufacture of which was taken over by the Baldwin Locomotive Works and later by a group of business men of Erie, Pa. He was also with Bement, Miles & Company, where he developed a high duty reciprocating pumping engine which was manufactured by the Heisler Pumping Engine Company, of which he was vice-president and chief engineer until 1907 when the plant was discontinued. He then became connected with the American Locomotive Company as a member of its staff of mechanical engineers, and at a later period served as mechanical engineer of the Washington Steel & Ordnance plant. He joined the General Electric organization in 1922, and was in charge of the mechanical engineering branch of the general superintendent's office. From 1926 until the time of his death he was in the engineering general department. Among his principal inventions, in addition to the Heisler geared locomotive, were various types of pumping engines and machinery, steam road rollers, barometric condensers and the wet type vacuum pump. He had been granted 21 patents since joining the staff of the General Electric Company.

William K. Bixby, a former president of the American Car & Foundry Company who died in St. Louis, Mo., on October 29, from myocarditis, was born at Adrian, Mich., on January 2, 1857, and received the degree of master of arts at Amherst College in 1913, and the degree

Strauss Studio

William K. Bixby

of doctor of law at the University of Missouri in 1907. He entered railway service in 1873 as a baggageman on the International Great Northern at Palestine, Tex., and later was employed in the baggage department of the Houston Union Station and still later, as general baggage agent of the International Great Northern. After he had been with the railroad several years, Mr. Bixby joined the Missouri Car & Foundry Company and, after becoming president of this company, played a prominent part in the merger with the Michigan Peninsular Car Company. This merger was the first step in the consolidation of 13 firms which in 1899, formed the American Car & Foundry Company, of which Mr. Bixby was appointed president. Soon after the consolidation, he became chairman of the board and in 1905, retired. Since his retirement, he served as one of the receivers of the Wabash from 1909 to 1914, and a director of the St. Louis Union Trust Company and engaged in many civic enterprises. He was a charter member of the Incorporation of the American Red Cross, and had served as honorary president of the Provident Association and Archaeological Society, president of the City Art Museum of St. Louis, president of Washington University, a trustee of the Y. W. C. A. Endowment Fund, and a director of the National Gallery of Arts, Washington, D. C.

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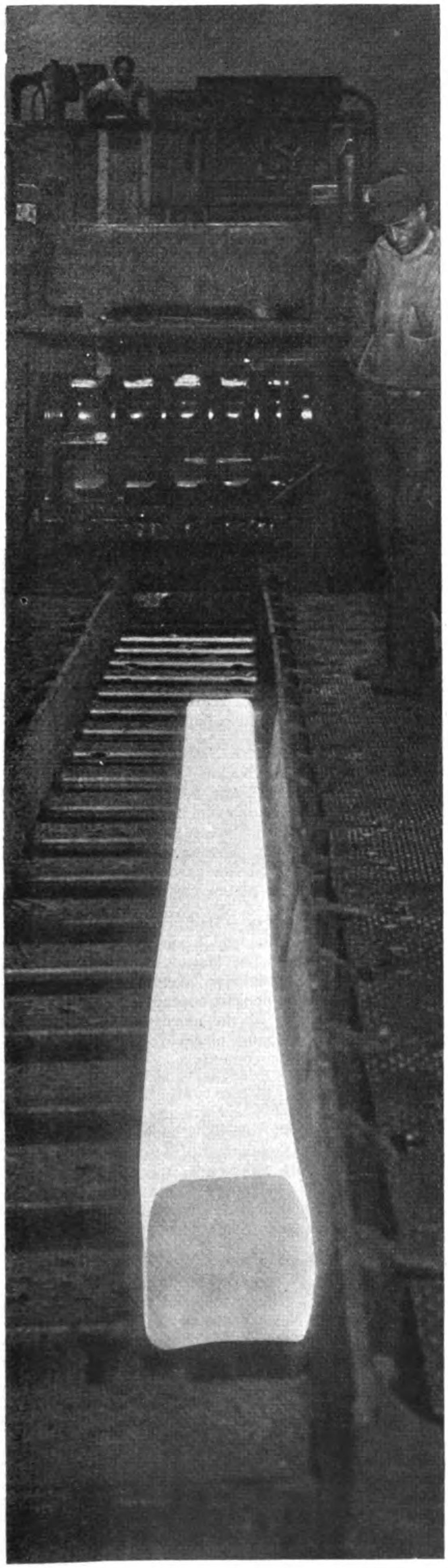


Personal Mention

General

J. W. SENGER, superintendent of rolling stock of the New York Central, Lines West of Buffalo, with headquarters at Cleveland, Ohio, has had his jurisdiction extended to include the Ohio Central Lines.

W. F. ACKERMAN, superintendent of shops on the Chicago, Burlington & Quincy, Lines West, of the Missouri river, at Havelock, Neb., has been transferred to Lines East of the Missouri river, at West Burlington, Iowa, to succeed H. C. Gugler.

Master Mechanics and Road Foremen

J. S. FORD has been appointed assistant master mechanic of the Chicago and Aurora divisions of the Chicago, Burlington & Quincy, with headquarters at Aurora, Ill.

T. E. PARADISE, master mechanic of the Alliance division of the Chicago, Burlington & Quincy, with headquarters at Alliance, Neb., has had his jurisdiction extended to include the Sterling division.

H. C. GUGLER has been appointed master mechanic of the Galesburg and East Ottumwa divisions, of the Chicago, Burlington & Quincy, with headquarters at Galesburg, Ill., succeeding G. P. Trachta.

G. B. PAULEY, master mechanic of the Casper division of the Chicago, Burlington & Quincy at Casper, Wyo., has beeen appointed assistant master mechanic of the Sterling division, with headquarters at Sterling, Colo.

RICHARD KLING has been appointed assistant master mechanic of the Central Kansas, Colorado and Wichita divisions of the Missouri Pacific, with headquarters at Wichita, Kan.

G. T. CALLANDER, master mechanic of the Central Kansas and Wichita divisions of the Missouri Pacific, with headquarters at Osawatomie, Kan., has had his jurisdiction extended to include the Colorado division, succeeding W. C. Smith.

G. P. TRACHTA, master mechanic of the Galesburg and East Ottumwa divisions of the Chicago, Burlington & Quincy, at Galesburg, Ill., has been transferred to the La Crosse division, with headquarters at North La Crosse, Wis.

W. C. SMITH, master mechanic of the Missouri Pacific at Hoisington, Kan., has been transferred to Dupo, Ill., with jurisdiction over the Dupo terminals of the St. Louis Terminal division and the Illinois division, including the Missouri-Illinois, east of the Mississippi river.

A. B. WILSON, assistant master mechanic of the Portland division of the Southern Pacific, Pacific Lines, with headquarters at Eugene, Ore., has been promoted to master mechanic of the same division, with headquarters at Portland, Ore., to succeed C. L. Gibson, who has retired.

C. R. DAVENPORT, master mechanic of the Sterling division of the Chicago Burlington & Quincy at Sterling, Colo., has been transferrred to Casper, Wyo., with jurisdiction over the Casper and Sheridan divisions.

Shop and Enginehouse

J. M. HOUSEHOLDER, JR., general enginehouse foreman of the Southern at Spencer, N. C., has been transferred to the position of night enginehouse foreman at Winston-Salem, N. C.

E. R. BLACKMON, assistant day enginehouse foreman of the Southern at Spencer, N. C., has been appointed assistant night enginehouse foreman.

R. B. STEWART, assistant day enginehouse foreman of the Southern at Spencer, N. C., has been promoted to the position of night enginehouse foreman.

R. B. WHEELER, enginehouse foreman of the Southern at Birmingham, Ala., has been promoted to the position of general foreman, with headquarters at Danville, Ky.

L. G. TREXLER, night enginehouse foreman of the Southern at Winston-Salem, N. C., has been transferred to the position of assistant enginehouse foreman, day, at Greensboro, N. C.

Purchasing and Stores

B. A. AIKENS, purchasing agent of the Michigan Central, has been appointed local purchasing agent at Detroit, Mich.

HARRY CARTER has been appointed local purchasing agent of the Michigan Central at Cincinnati, Ohio.

H. C. PEARCE has resigned as director of purchases and stores of the Chesapeake & Ohio and the Pere Marquette.

G. S. WRIGHT, general storekeeper of the Elgin, Joliet & Eastern with headquarters at Joliet, Ill., has retired after 35 years of continuous service with that road.

Obituary

P. T. DUNLOP, retired superintendent of motive power of the St. Louis-San Francisco, died at his home at Willard, Mo., on October 4.

E. F. HASBROOK, purchasing agent of the Chicago, Burlington & Quincy, with headquarters at Chicago, died on November 22, in the Presbyterian hospital at that point, of pneumonia.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

CONTINUOUS BLOW-DOWN SYSTEM.—The Elgin continuous blow-down system for boiler plants, with the Eckel precision control, is described in a four-page folder issued by the Elgin Softener Corporation, Elgin, Ill.

POTENTIOMETER PYROMETER.—The Brown Instrument Company, Philadelphia, Pa., describes and illustrates in its new 16-page booklet the principal features of the new Brown Potentiometer pyrometer.

LUKENWELD CONSTRUCTION.—The problems encountered in the development of the Lukenweld type of gear construction are described by Everett Chapman, director of engineering and research, in an eight-page bulletin issued by Lukenweld, Inc., Coatesville, Pa.

TAPS.—A comprehensive booklet covering Class S collapsing taps has been issued by The Geometric Tool Company, New Haven, Conn. The taps are applicable to most standard makes of machines and can be readily converted from one type of trip to another.

NICKEL-STEEL SPECIFICATIONS.—The International Nickel Company, 67 Wall street, New York, has issued Nos. 1 to 8 of its Recommended Specifications for Nickel Alloy Steel in railroad applications. These cover forging billets, normalized and tempered low-carbon forgings, boiler and firebox plates, castings, nickel engine

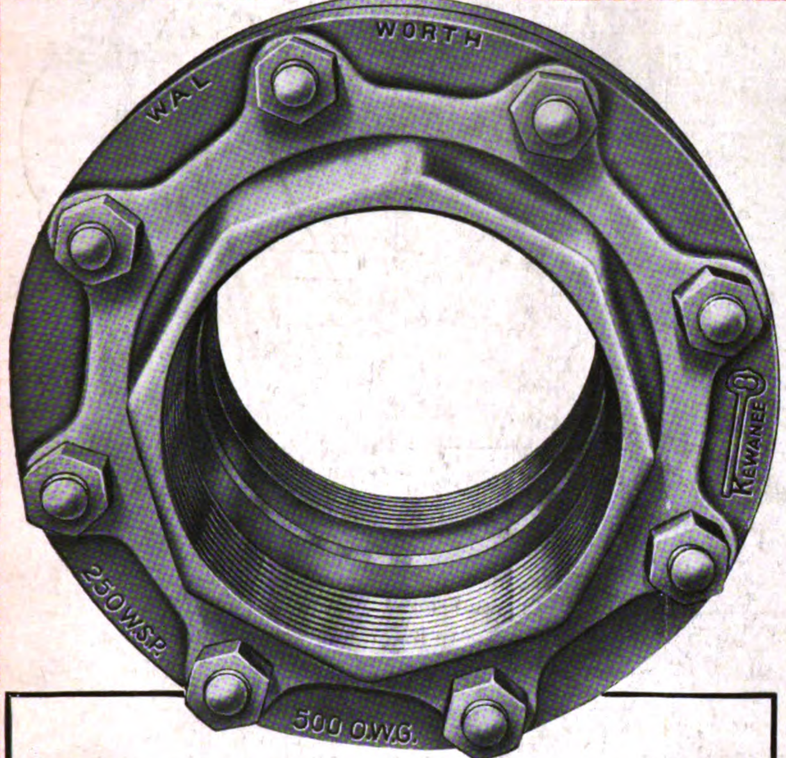
SMOOTH-ON.—"Helpful Ideas for Engineers" is the title of a booklet issued by the Smooth-On Manufacturing Company, 568 Communipaw avenue, Jersey City, N. J. This booklet contains an abbreviated description of the more simple and common types and places for application of Smooth-On cements.

HIGH TEMPERATURE MORTARS.—"High Temperature Mortars and Plastic Chrome Ore" is the title of a booklet being issued by the General Refractories Company, 106 South Sixteenth street, Philadelphia, Pa. The advantages and applications of high temperature mortars and plastic chrome ore are described in this booklet.

PUTNAM PRODUCTS.—The Putnam Machine Works of Manning, Maxwell & Moore, Inc., 100 East Forty-Second street, New York, presents in an illustrated catalog of 72 pages a diversified line of machine tools for industrial service and a specially designed line for railroad shop service. The catalog is attractively bound and is of pocket size. Separate pieces of literature have also been issued describing Putnam double housing planers, open-side planers, the 90-in. quartering and pin turning machine, unit heads for milling machines, the Shaw electric drop pit table, etc.

Railway Mechanical Engineer

FOUNDED IN 1832



Where service conditions are hard and tight joints imperative, engineers play safe by insisting upon the Kewanee Flange Union . . . Fig. 8301. Note these advantages:

Iron to bronze seat, insuring leakless joint.

Loose flange, permitting swiveling to any position to match bolt holes.

Light weight combined with extraordinary strength and rigidity.

Only sterling performance over many years could have won the Kewanee Flange Union's world wide reputation for quality.

Kewanee All-Iron Malleable Flange Union (Fig. 8302) also available.

SERVICE RECOMMENDATIONS	Working Steam Pressure	Cold Water Oil and Gas Pressure
Sizes 1″ to 4″ inclusive	300 lbs.	800 lbs.
Sizes 5″ and 6″	250 lbs.	500 lbs.
Sizes 8″ to 12″ inclusive	200 lbs.	400 lbs.

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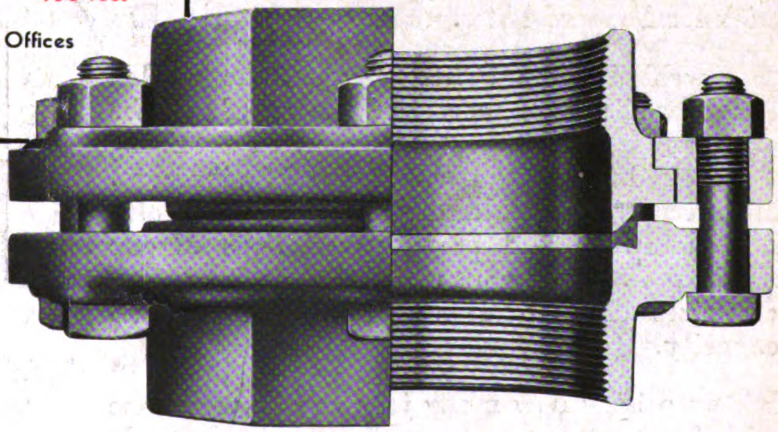


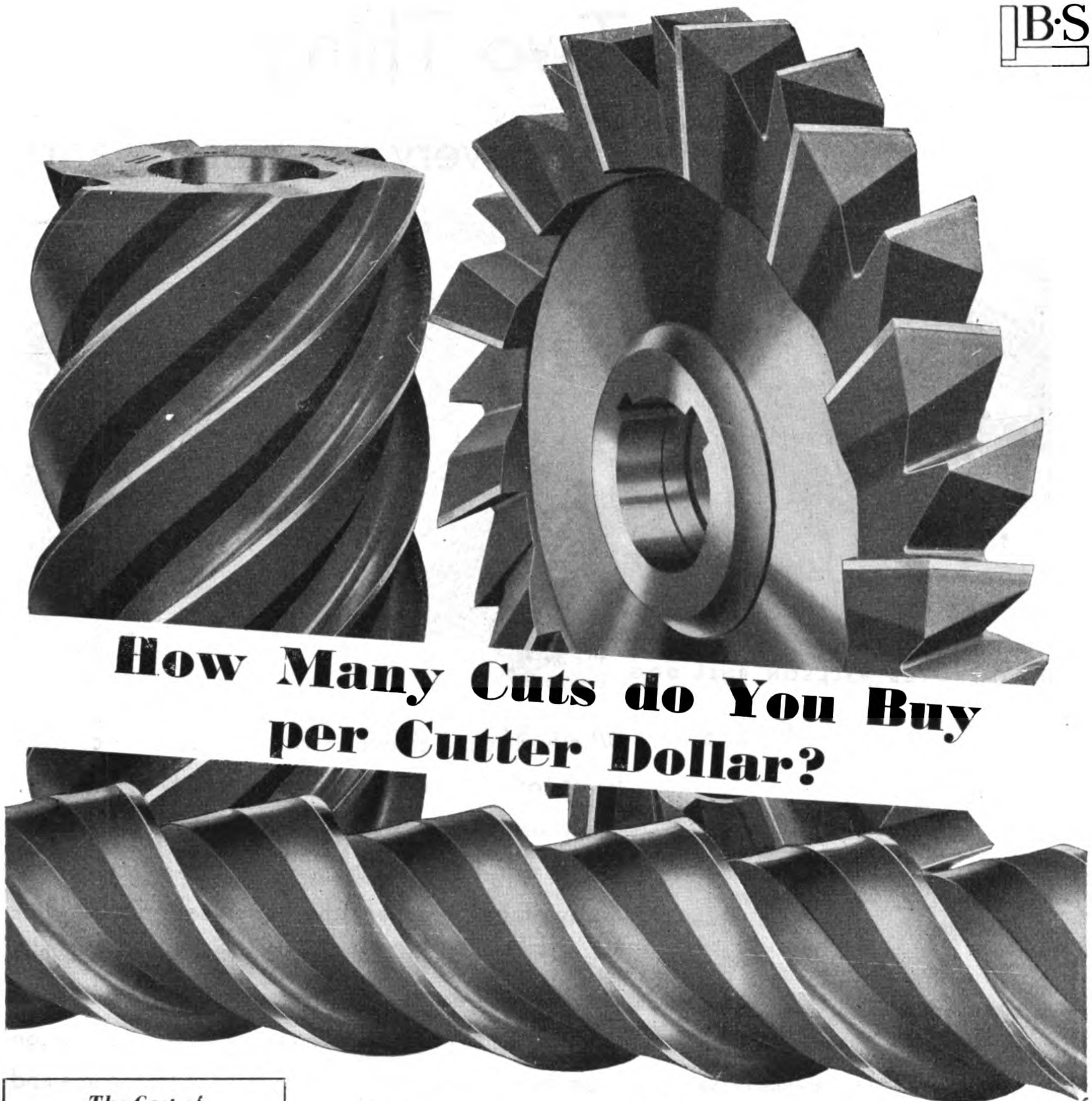
THE KEWANEE FLANGE UNION

WALWORTH

December 1931 35¢

Vol. 105. No. 12
Published monthly by Simmons-Boardman Publishing Company, 34 North Crystal Street, East Stroudsburg, Pa. Entered as second class matter, March 10, 1928, at the post office at East Stroudsburg, Pa., under the act of March 3, 1879.

B·S



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The Cost of
Time Lost Removing Cutters
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Plus Lost Production
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Plus Original Purchase
Equals
Real Cost of Cutters

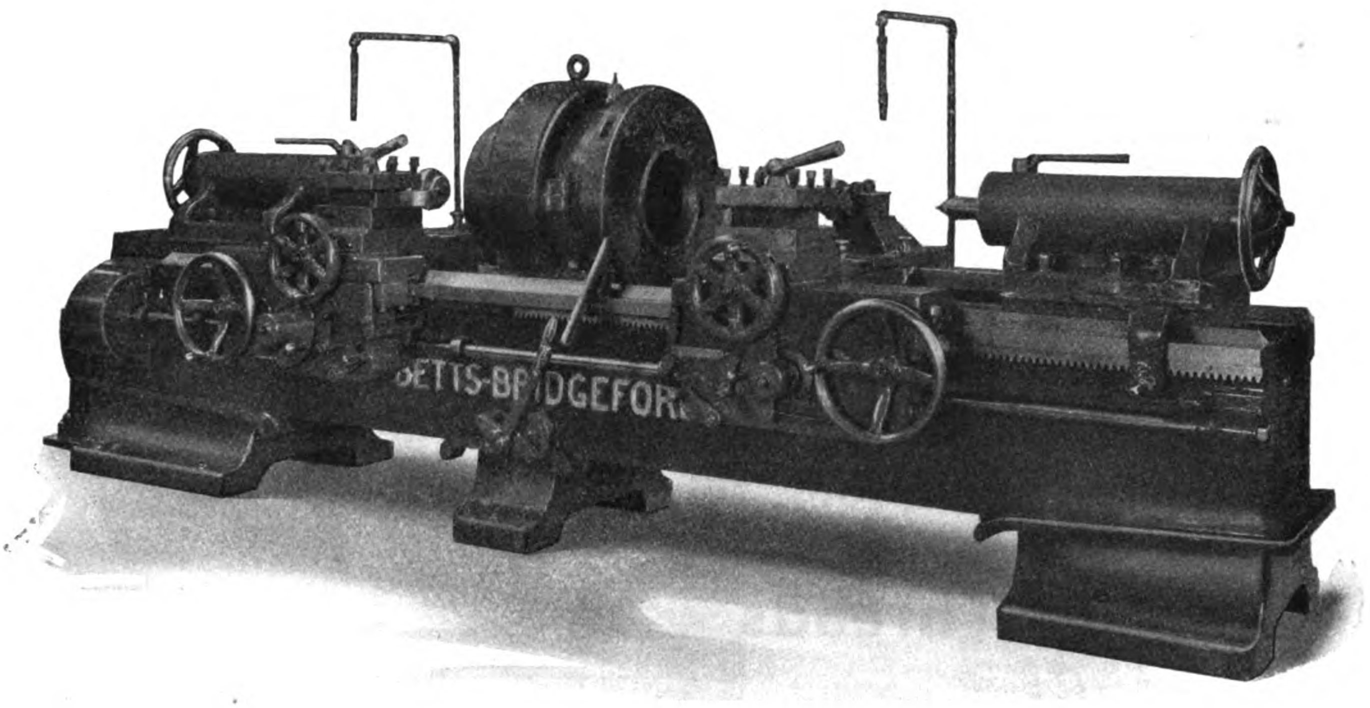
What Is the *Real* Cost of Your Cutters?

Whether or not you think of your money directly in terms of cutter performance, it's actually the number of cuts per dollar that determine a cutter's value. Buy cutters that give you the greatest number of cuts—that stand up best under heavy feeds at fast speeds—*Brown & Sharpe Cutters!* . . . These cutters give you the most value, the greatest number of cuts per dollar investment. Ask for Small Tool Catalog No. 31 listing the complete line. Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

Brown & Sharpe Cutters

MODERN—EFFICIENT—KEEP COSTS LOW

Opposed burnishing for journals on the Betts-Bridgeford Axle Lathe



The new features on the Betts-Bridgeford Axle Lathe include opposed burnishing using 4 rollers, automatic equalizing driver and positive clutches in the apron which can be released by slight pressure instantly.

Opposed burnishing removes strain from the centers and the automatic driver shortens the setting time. The new apron clutches allow the operator to run closer to the fillet before throwing out the power feed, and all of the new features combined increase the already high production on this machine materially. Write for details on this improved lathe.

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CONSOLIDATED MACHINE TOOL CORPORATION *of* AMERICA, Rochester, N. Y.

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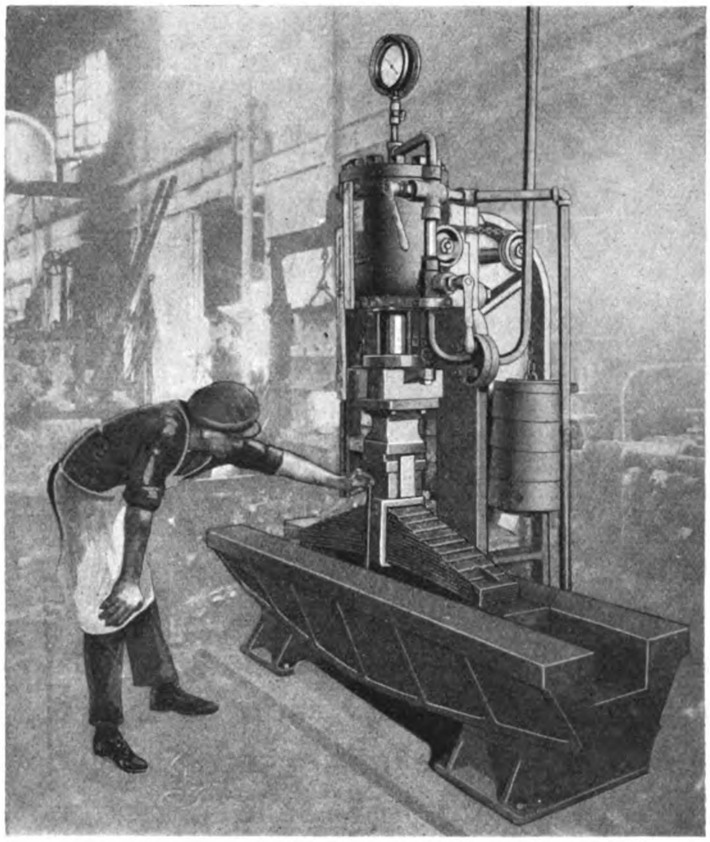
**with these Labor Saving—Time Saving—
Material Saving Machines**



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HYDRAULIC SPRING TESTING MACHINES

It will soon pay for itself in the saving of the cost of breaking down and setting up of springs that tests show to be still serviceable.

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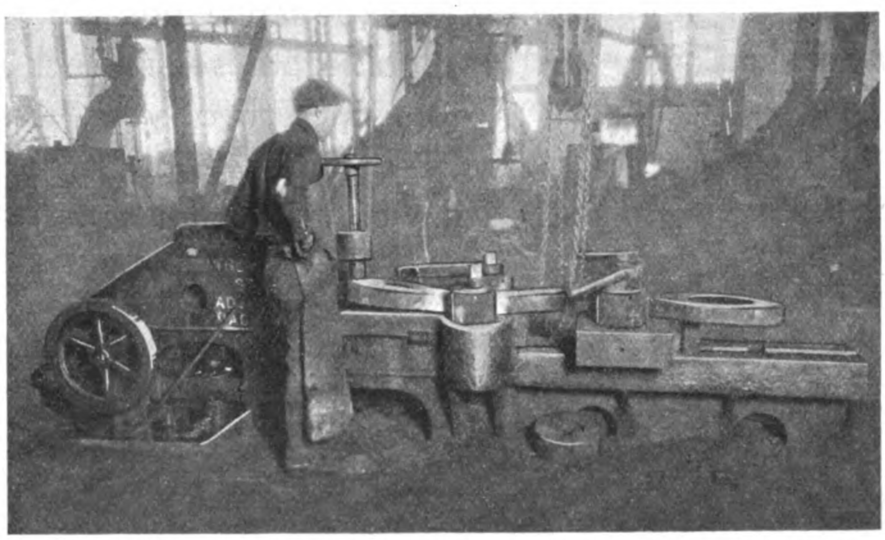
Walter Stock Adjusting Machines
Riley Axle Straightening Presses

Write for Catalogs

If you are still using hand methods for those straightening, shortening and lengthening jobs your blacksmith shop costs are bound to be high.

Ask us about THE WALTER STOCK ADJUSTING MACHINE. The time and labor saving machine.



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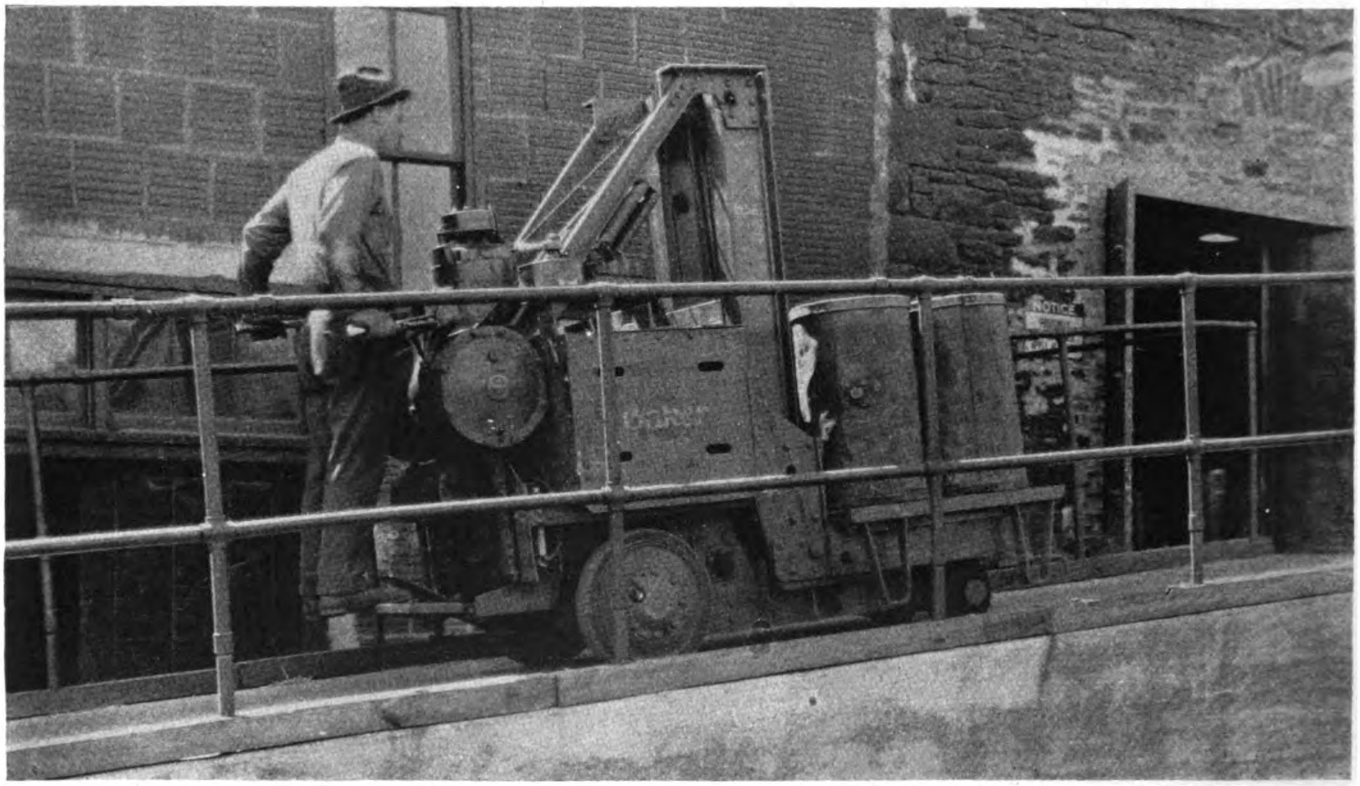

Get a REPORT from BAKER

Opportunities of cost reduction by industrial trucks are no longer questioned by shop executives. It is a matter of survey—experienced observation determines where and how such opportunities can be found. ▲ Much technical training and practical experience has made the Baker engineer a valuable adviser in truck operation. ▲ His report, after analysis of your handling methods, will give you definitely established facts showing where and how cost reduction opportunities exist in your plant.

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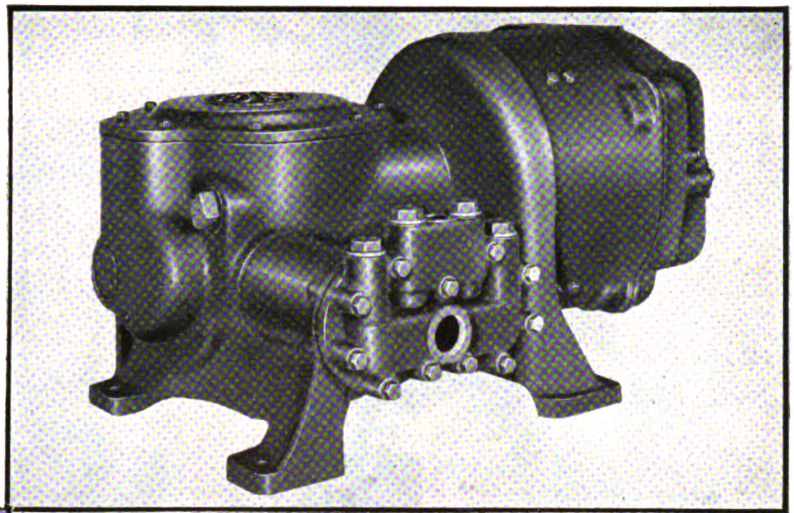
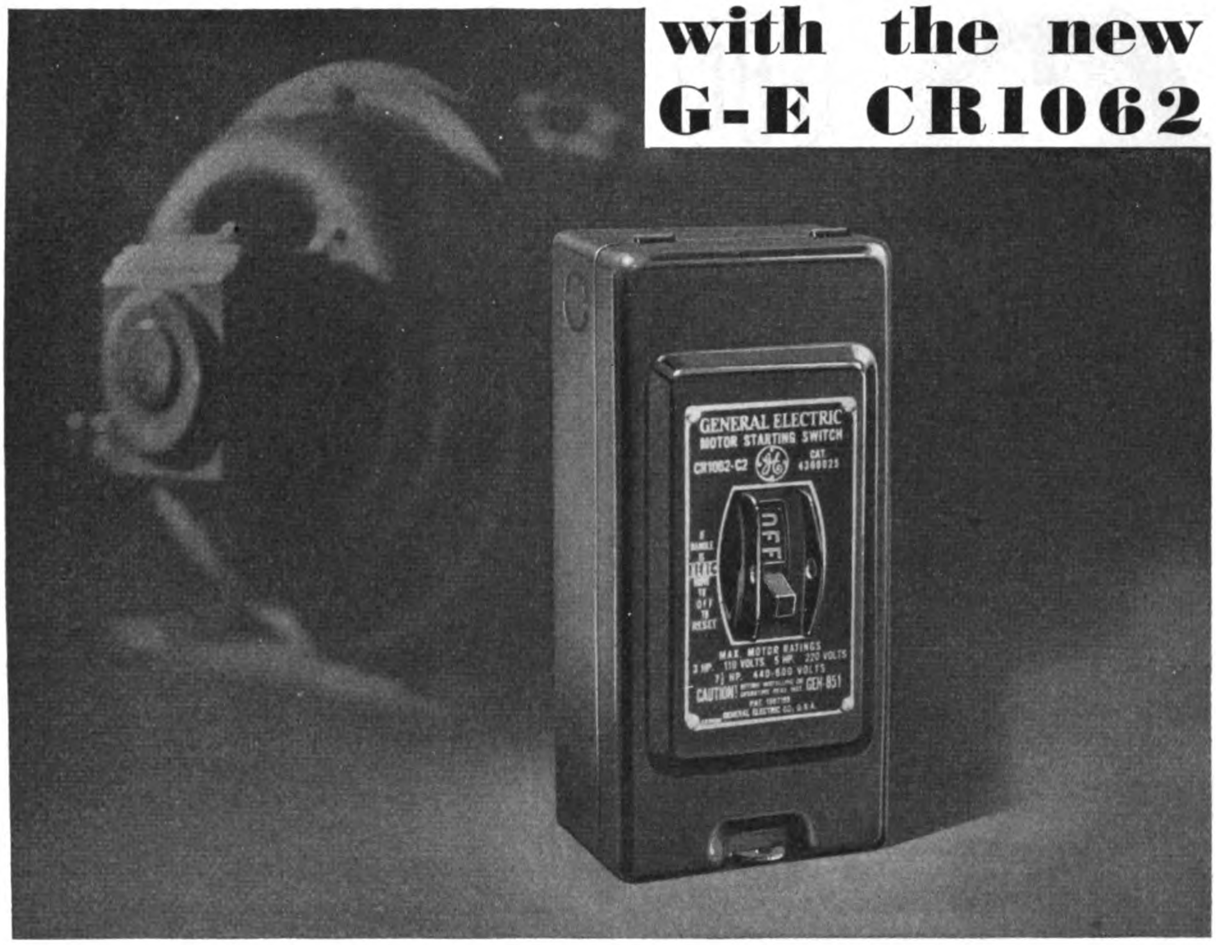


START RIGHT with the new G-E CR1062



The new G-E CR1062 manually operated motor-starting switch . . . good to look at both inside and out . . . mechanically and electrically correct . . . perfect partner in any combination that includes a small induction motor

AN a-c. motor-starting switch that's reliable ... simple ... easily wired ... yet inexpensive

In the new manually operated CR1062 motor-starting switch with hand-reset thermal overload device, General Electric offers you a switch that is not only moderately priced but easy and inexpensive to install. It is designed for full-voltage starting of small induction motors. It is good to look at. Built in a finely proportioned case with rounded corners, the CR1062 harmonizes with the lines of your most prized installation.

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301-92

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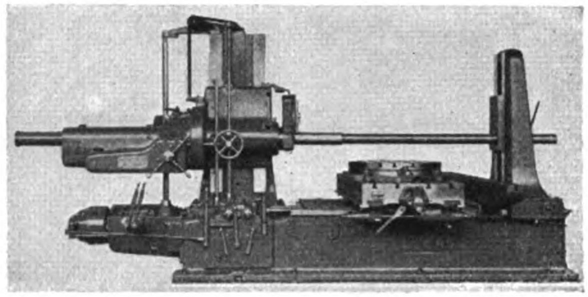

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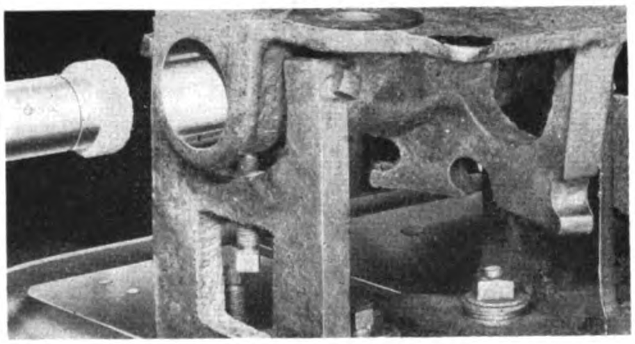

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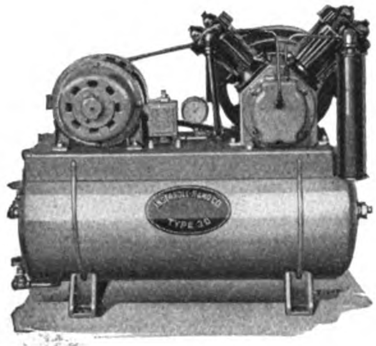

Type 30, complete with receiver, available in many sizes.

INGERSOLL-RAND builds more than 1000 different types and sizes of compressors. They range in piston displacement from 3 to more than 30,000 cubic feet per minute. They include units for handling air under any pressure conditions. Any commercial type of drive is available.

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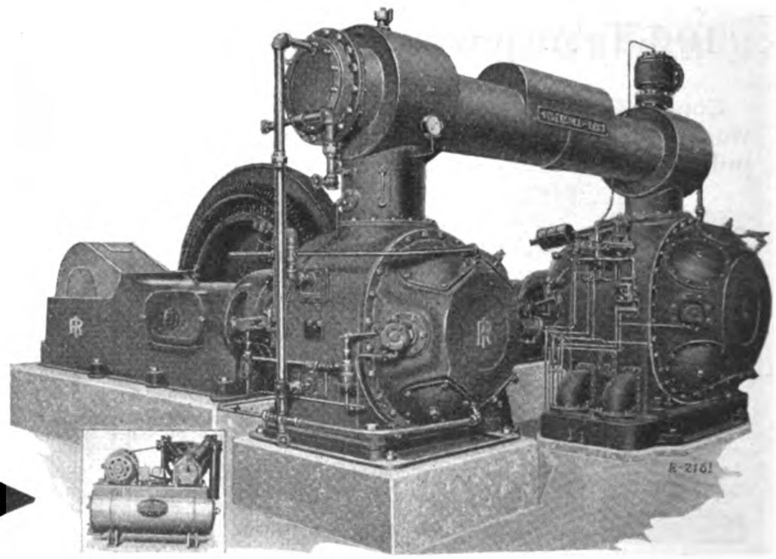
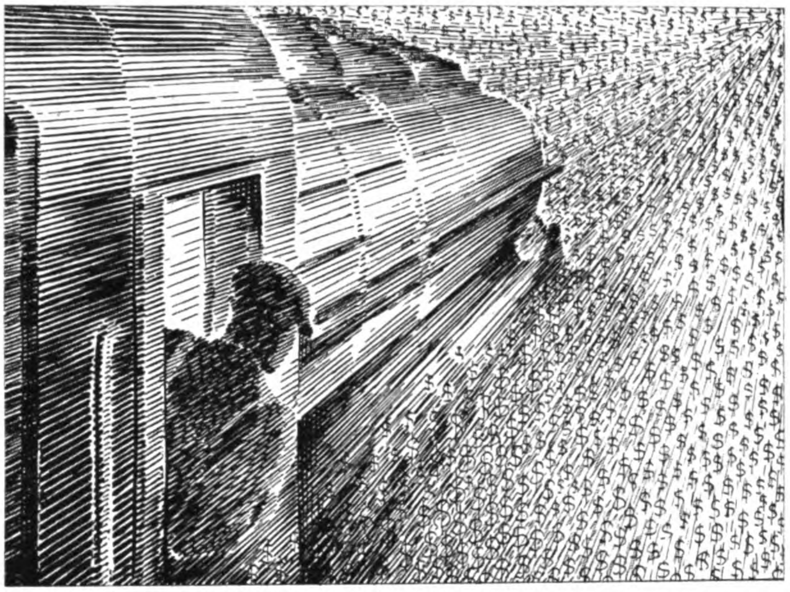
Class "PRE" direct-connected, synchronous motor-driven unit. Made in sizes ranging from 208 to 1,270 horsepower. This view and the inset show the comparative sizes of the smallest Type 30 and largest Class "PRE."



1030-C

Ingersoll-Rand

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CARDWELL AND WESTINGHOUSE DRAFT GEARS Fulfill All A.R.A Requirements

HOLD THOSE SPECIFICATIONS!

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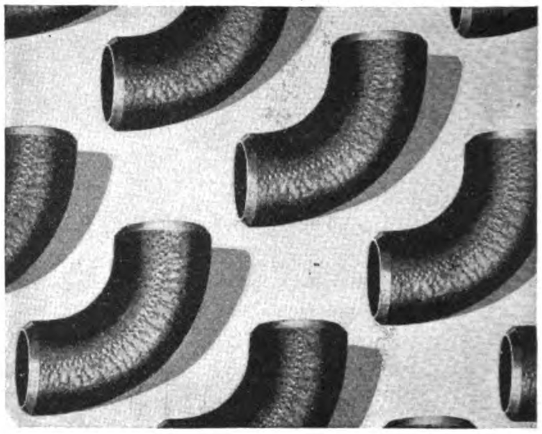
Here's real news for Pipe Users...



SINCE welding fittings were first developed there has been a steadily increasing demand for such fittings made of genuine Reading *Puddled* Iron — the kind of wrought iron that has proved its value by generations of service.

Such welding fittings are now available—*for the first time.*

Now you can make a welded Reading Puddled Iron Pipe system of superior resistance to corrosion, at every point.

Now you can make piping systems of other metals *better* by using welding ells of this superior material at critical points.

Now you can be assured of longer life in piping systems, greater freedom from trouble *plus* the efficiency of welding fittings.

Made by MIDWEST *from Reading Puddled Iron*

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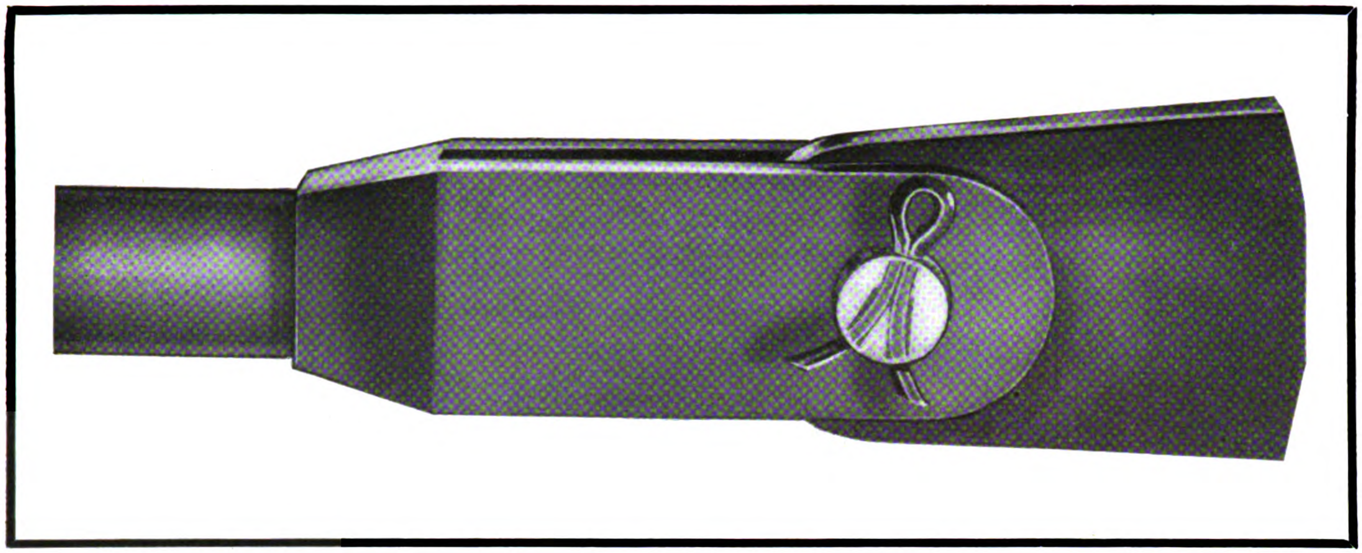
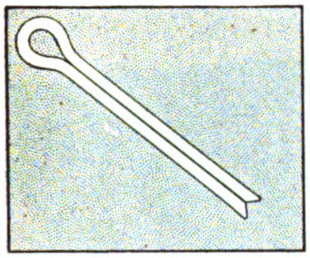
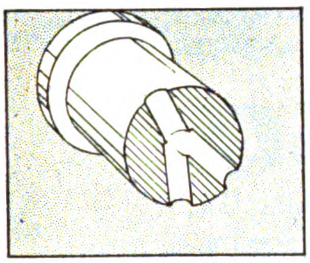
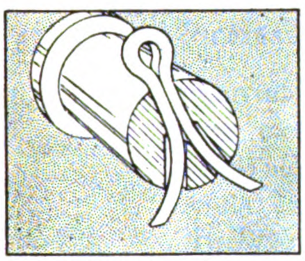


COOKE PATENTED PIN *and* COTTER







Self-Opening — Self-Retaining

THE accompanying illustrations show that the Cooke Cotter is an ordinary cotter with the prongs forming an internal "V" for easy spreading and the pin or *bolt* bored with a "Y" shaped hole. The cotter is simply inserted in the proper hole and tapped lightly with a hammer. The first tap spreads the prongs of the cotter on the wedge formed by the intersection of the two lower holes. Further taps drive the cotter home, spreading the prongs at a wide angle and binding them tightly against the sides of the "Y" shaped hole, locking the cotter firmly and thus eliminating vibration and the resulting wear. No additional bending of the cotter prongs is necessary. The "Y" shaped hole is provided with shoulders above the wedge which prevent the cotter from entering any except the right hole, thereby making it fool proof. These shoulders also wedge the prongs by tending to create an "S" curve. A Cooke Cotter will never work loose, even under the most severe vibrations.

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Niles Tool Works Co., The
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Boring & Facing Machines.
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Betts Works of Consolidated Machine Tool Corp. of America.
Colburn Machine Tool Plant of Consolidated Machine Tool Corp. of America.
Niles Tool Works Co., The
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Boring Machines, Car Wheel.
Betts Works of Consolidated Mach. Tool Corp. of America.
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Sellers & Co., Inc., Wm.

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Betts Works of Consolidated Mach. Tool Corp. of America
Newton Works of Consolidated Mach. Tool Corp. of America.
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Sellers & Co., Wm., The
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Underwood Corp., H. B.

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Castings, Steel Locomotive.
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Chucks, Drill.
Ingersoll-Rand Co.
Modern Tool Works of Consolidated Machine Tool Corp. of America.

Chucks, Quick Change.
Geometric Tool Co., The.
Modern Tool Works of the Consolidated Mach. Tool Corp. of America.

Chucks, Staybolt Driving.
Ingersoll-Rand Co.

Clamps, Flanging.
Niles Tool Works Co., The

Clamps, Hose.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
National Malleable & Steel Castings Co.

Clamps, Pipe.
National Malleable & Steel Castings Co.

Clamps, Rail Cutting.
Oxweld Railroad Service Co.

Cleaning Methods.
Oakite Products Inc.

Cocks.
Lunkenheimer Co.

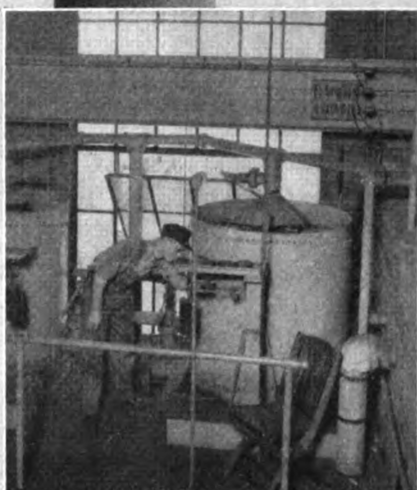
Collets.
Brown & Sharpe Mfg. Co.
Geometric Tool Co., The.

Compounds, Boiler.
Dearborn Chemical Co.

Compounds, Cleaning.
Ford Co., J. B.
Oakite Products, Inc.

SYPHONS

Increase Boiler Efficiency 8.47%



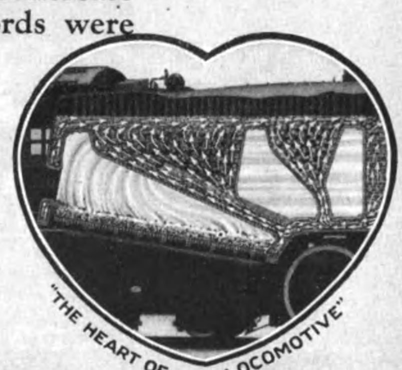
The water used was weighed and accurately recorded

The tests were fired by Mr. Kelly Taylor, 18 years with the Illinois Central Railroad, and selected by the railway company representatives

Weighing and recording coal. All coal used was Williamson County (Illinois) No. 6

● Throughout the tests at the University of Illinois in 1930, which established that Syphons increase boiler efficiency 8.47%, accurate records were kept of every relevant detail.

The University's Bulletin No. 220 states: "At all rates of evaporation the Syphon-equipped locomotive showed a definite and notable superiority over the non-Syphon engine as regards both evaporation per pound of coal and boiler efficiency."



CIRCULATION
SAFETY
ECONOMY

LOCOMOTIVE FIREBOX COMPANY

NEW YORK CHICAGO MONTREAL

Compressors, Air.
General Electric Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Westinghouse Air Brake Co.
Worthington Pump & Machinery Corp.

Compressors Air, Portable.
General Electric Co.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Westinghouse Air Brake Co.
Worthington Pump & Machinery Corp.

Condensing Apparatus.
Ingersoll-Rand Co.
Worthington Pump & Machinery Corp.

Condensing Plants.
Ingersoll-Rand Co.

Condensers.
Ingersoll-Rand Co.
Worthington Pump & Machinery Corp.

Conduit, Flexible.
Barco Mfg. Co.
Franklin Ry. Supply Co.

Connections.
National Malleable & Steel Castings Co.

Connections, Lever.
National Malleable & Steel Castings Co.

Connections, Truck.
National Malleable & Steel Castings Co.

Connectors, Electrical.
Westinghouse Elec. & Mfg. Co.

Controllers.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Cotter Pins & Cotters.
American Railway Products, Inc.

Countershafts.
Brown & Sharpe Mfg. Co.

Couplers.
American Steel Foundries.
Franklin Ry. Supply Co.
National Malleable & Steel Castings Co.

Couplings, Hose.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
Westinghouse Air Brake Co.

Couplings & Hose Nuts, Steel, Bronze.
Sellers & Co., Wm., The

Couplings, Pipe.
Dart Mfg. Co., E. M.
Walworth Co.

Cranes.
Baker-Raulang Co.

Cranes, Electric Industrial, Truck Mounted.
Baker-Raulang Co.

Cranes, Hydraulic.
Chambersburg Engineering Co.

Crank Pin Turning Machines, Portable.
Micro Machine Co.
Rooksby & Co., E. J.
Underwood Corp., H. B.

Cross Head Pin Ejectors.
Watson-Stillman Co.

Cross Heads and Cross Head Shoes.
Barco Mfg. Co.

Cutters, Gear.
Brown & Sharpe Mfg. Co.

Cutters, Rivet.
Ingersoll-Rand Co.

Cutters, Sprue.
Cleveland Punch & Shear Works Co.

Cutting Off Machines, Automatic, Lathe Type.
Brown & Sharpe Mfg. Co.

Cutting and Welding Apparatus.
Oxweld Railroad Service Co.

Cyclopedias, Railway.
Simmons-Boardman Pub. Co.

Cylinders, Cast Steel, Locomotive.
General Steel Castings Corp.

Cylinders, Compressed Air, Gas, Etc.)
National Tube Co.

Decarbonizing Equipment.
Oxweld Railroad Service Co.

Derailers, Portable (Mechanical and Hand Throw).
Q. & C. Co., The.

Dies.
Modern Tool Works of Consolidated Machine Tool Corp. of America.

Dies, Adjustable.
Geometric Tool Co., The.
Modern Tool Works of Consolidated Machine Tool Corp. of America.

Doors, Car.
Chicago Railway Equipment Co.

Doors, Locomotive Fire Box
Franklin Ry. Supply Co.

Draft Arms.
American Steel Foundries

Draft Gear Yokes
American Steel Foundries
National Malleable and Steel Castings Co.

Draft Gears.
Cardwell Westinghouse Co.
National Malleable & Steel Castings Co.

Draft Rigging and Attachments.
Cardwell Westinghouse Co.
General Steel Castings Corp.

Draft Yokes.
American Steel Foundries
National Malleable & Steel Castings Co.

Drilling Machines, Gang.
Colburn Mach. Tool Works of Consolidated Machine Tool Corp. of America.
Niles Tool Works Co., The

Drilling Machines, Heavy Duty.
Betts Works of Consolidated Machine Tool Corp. of America.
Colburn Mach. Tool Works of Consolidated Machine Tool Corp. of America.
Niles Tool Works Co., The
Sellers & Co., Inc., Wm.

Drilling Machines, Multiple Spindle.
Colburn Mach. Tool Works of Consolidated Machine Tool Corp. of America.
Niles Tool Works Co., The

Drilling Machines, Portable, Electric.
Independent Pneumatic Tool Co.

Drilling Machines, Portable, Pneumatic.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.

Drilling Machines, Radial.
Cleveland Punch & Shear Works Co.
Niles Tool Works Co., The
Sellers & Co., William.

Drilling Machines, Rail.
Colburn Mach. Tool Works of Consolidated Machine Tool Corp. of America.
Newton Works of Consolidated Machine Tool Corp. of America.
Niles Tool Works Co., The
Sellers & Co., Inc., Wm.

Drilling Machines, Rock.
Ingersoll-Rand Co.
Worthington Pump & Machinery Corp.

Drilling Machines, Vertical.
Colburn Mach. Tool Works of Consolidated Machine Tool Corp. of America.
Sellers & Co., Inc., Wm.

Drills.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.

Drills, Close Corner.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.

Drills, Core.
Ingersoll-Rand Co.

Drills, Pneumatic.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.

Drills, Rock.
Ingersoll-Rand Co.
Worthington Pump & Machinery Corp.

Drills, Track and Bonding.
Ingersoll-Rand Co.

Driving Boxes, Locomotive.
Franklin Ry. Supply Co.

Drop Pit Tables (Hydraulic)
Watson-Stillman Co.

Electric Supplies.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

End Frames, Cast Steel, Passenger Car.
General Steel Castings Co.

Engines, Crude and Fuel Oil
Worthington Pump & Machinery Corp.

Engines, Diesel Oil.
Worthington Pump & Machinery Corp.

Engines, Gas and Gasoline.
Ingersoll-Rand Co.
Worthington Pump & Machinery Corp.

Expanders, Tube.
Watson-Stillman Co., The

Fans, Electric.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Fans, Ventilating.
General Electric Co.

Fasteners, Car Door.
National Malleable & Steel Castings Co.

Feedwater Heaters, Locomotive.
Worthington Pump & Machinery Corp.

Feedwater Heaters, Stationary.
Worthington Pump & Machinery Corp.

Fittings, Air Brake.
Westinghouse Air Brake Co.

Fittings, Brass.
Lunkenheimer Co.

Fittings, Gas Fixtures.
Dart Mfg. Co., E. M.

Fittings, Hydraulic.
Chambersburg Engineering Co.
Watson-Stillman Co., The.

Fixtures, Car Door.
National Malleable & Steel Castings Co.

Flanges, Pipe.
Dart Mfg. Co., E. M.

Flanges, Snow and Ice.
Q. & C. Co., The

Floodlights, Acetylene.
Oxweld Railroad Service Co.

Forging Machines.
Ajax Manufacturing Co.
Acme Machinery Co.

Forgings.
Baldwin Locomotive Works, The.
Bethlehem Steel Co.
Carnegie Steel Co.

Forgings, Drop.
Baldwin Locomotive Works, The.

Frames, Cast Steel, Locomotive.
American Steel Foundries
General Steel Castings Corp.

Frogs & Crossings.
Bethlehem Steel Co.

Fulcrums, Brake Beam.
American Steel Foundries.
National Malleable & Steel Castings Co.

Gages.
Ashton Valve Co.
Brown & Sharpe Mfg. Co.
General Electric Co.
Lunkenheimer Co.

Gages, Acetylene & Oxygen.
Oxweld Railroad Service Co.

Gage Cocks.
Lunkenheimer Co.

Gages, Dial.
Brown & Sharpe Mfg. Co.

Gage Glasses.
Jenkins Brothers.

Gages, Height, Depth, Thickness, Screw, Etc.
Brown & Sharpe Mfg. Co.

Gages, Oil.
Lunkenheimer Co.

Gages, Plug.
Brown & Sharpe Mfg. Co.

Gages, Pressure.
Ashton Valve Co.
Watson-Stillman Co., The

Gages, Recording.
General Electric Co.

Gages, Ring.
Brown & Sharpe Mfg. Co.

Gages, Snap.
Brown & Sharpe Mfg. Co.

Gages, Steam.
Ashton Valve Co.

Gages, Surface.
Brown & Sharpe Mfg. Co.

Gages, Tool.
Brown & Sharpe Mfg. Co.

Gages, Wheel Press Recording.
Ashton Valve Co.

Gaskets.
Garlock Packing Co., The.
Westinghouse Air Brake Co.

Gear Cutting Machines.
Brown & Sharpe Mfg. Co.

Gears, Cut.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Gears, Fabric.
General Electric Co.

Gears, Special, Cut to Order.
Brown & Sharpe Mfg. Co.

Generators, Electric.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Grate Shakers.
Franklin Ry. Supply Co.

Grease Forming Machines.
Franklin Ry. Supply Co.

Grease Cups.
Lunkenheimer Co.

Grease Guns, High Pressure.
Reliance Machine & Stamping Wks., Inc.

Grinders, Axle.
Niles Tool Works Co., The

Grinders, Crank Pin, Portable.
Micro Machine Co.

Grinders, Internal.
Micro Machine Co.

Grinders, Portable Crank Pin
Micro Machine Co.

Grinders, Rod, Portable Pneumatic.
Independent Pneumatic Tool Co.

Grinding Machines, Chucking.
Modern Tool Works of Consolidated Machine Tool Corp. of America.

Grinding Machines, Cutter and Reamer.
Brown & Sharpe Mfg. Co.
Landis Tool Co.
Thompson Grinder Co., The.

Grinding Machines, Cylindrical.
Brown & Sharpe Mfg. Co.
Landis Tool Co.
Modern Tool Works of Consolidated Machine Tool Corp. of America.
Thompson Grinder Co., The.

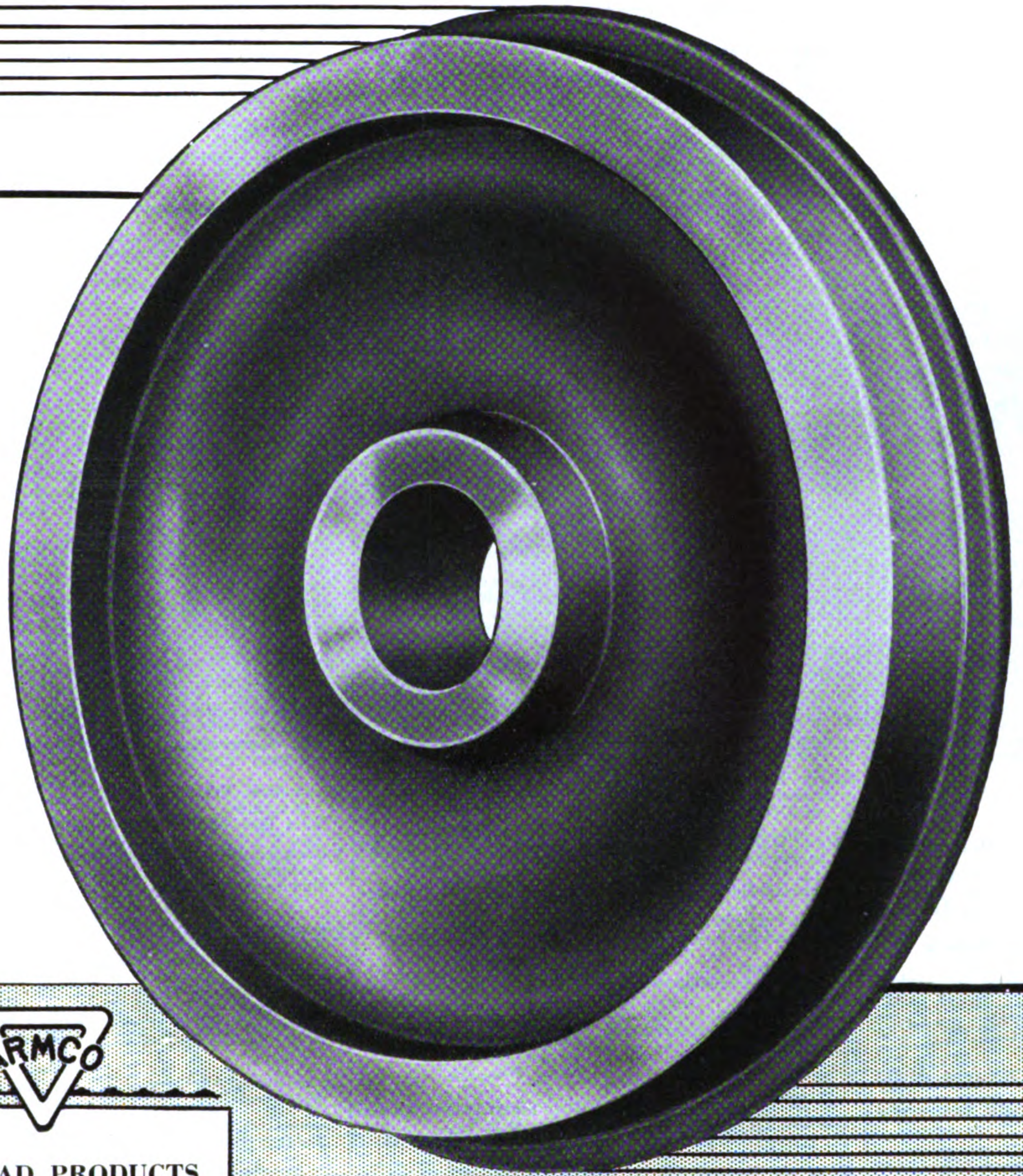
Grinding Machines, Die.
Acme Machinery Co., The.
Chambersburg Engineering Co.
Geometric Tool Co., The
Modern Tool Works of Consolidated Machine Tool Corp. of America.

Grinding & Pointing Machines, Drill.
Sellers & Co., Inc., Wm.

Grinding Machines, Edge.
Thompson Grinder Co., The.

Grinding Machines, Floor Type.
Modern Tool Works of Consolidated Machine Tool Corp. of America.

Grinding Machines, Gap.
Landis Tool Co.



Milling Machines, Radius.
Newton Works of Consolidated Machine Tool Corp of America.

Milling Machines, Slab.
Newton Works of Consolidated Machine Tool Corp. of America.
Niles Tool Works Co.

Milling Machines, Tread.
Newton Works of Consolidated Machine Tool Corp. of America.

Milling Machines, Universal.
Brown & Sharpe Mfg. Co.

Milling Machines, Vertical.
Betts Works of Consolidated Machine Tool Corp. of America.
Brown & Sharpe Mfg. Co.
Newton Works of Consolidated Machine Tool Corp. of America.
Niles Tool Works Co.

Mining Machinery.
Ingersoll-Rand Co.
Lima Locomotive Works.
Lucas Machine Tool Co.

Motors, Electric.
General Electric Co.
Westinghouse Elec. & Mfg Co.

Multiple V-Belt Drives.
Worthington Pump & Machinery Corp.

Nitrogen.
Oxweld Railroad Service Co.

Nozzles, Oxy-Acetylene Cutting.
Oxweld Railroad Service Co.

Nozzles, Exhaust.
Franklin Ry. Supply Co.

Nut Couplings.
Sellers & Co., Inc., Wm.

Nut Steel—Bronze Coupling.
Sellers & Co., Inc., Wm.

Nuts, Castellated.
Sellers & Co., Inc., Wm.

Nuts, Micro
American Railway Products Co., Inc.

Oil Cups.
Lunkenheimer Co., The.

Oil Plugs.
Franklin Ry. Supply Co.

Oil Pumps.
Lunkenheimer Co.

Oiling Systems.
Lunkenheimer Co.

Oxy-Acetylene Welding and Cutting — (See Cutting and Welding Apparatus)

Oxygen.
Oxweld Railroad Service Co.

Packing, Air Pump.
Garlock Packing Co., The

Packing, Asbestos.
Garlock Packing Co., The.

Packing, Leather.
Watson-Stillman Co.

Packing, Metallic.
Garlock Packing Co., The

Packing, Sheet.
Garlock Packing Co., The.

Packing, Soft.
Garlock Packing Co., The.

Packing, Valve Stem.
Garlock Packing Co., The.

Paint Burners, Acetylene.
Oxweld Railroad Service Co.

Paint Strippers.
Oakite Products, Inc.

Patterns for Castings, Brass, Iron, Steel.
Baldwin Locomotive Works, The.

Pedestal Jaw Facing Machines.
Underwood Corp., H. B.

Piling, Sheet Steel.
Bethlehem Steel Co.
Carnegie Steel Co.

Pilot Beams, Cast Steel.
General Steel Castings Co.

Pilots, Cast Steel.
General Steel Castings Co.

Pins, Coupler Knuckle.
National Malleable & Steel Castings Co.

Pipe Bending, Heavy.
Baldwin Locomotive Works, The.

Pipe Fitters' Tools.
Walworth Co.

Pipe Fittings.
Dart Mfg. Co.
Lunkenheimer Co.
Walworth Co.
Watson-Stillman Co.

Pipe, Spiral Welded.
Armco Railroad Sales Co.

Pipe, Steel-Signal.
National Tube Co.

Pipe Vises—(See Vises, Pipe)

Pipe Unions.
Dart Mfg. Co.
Lunkenheimer Co.
Walworth Mfg. Co.

Pipe, Welded Steel.
Bethlehem Steel Co., Inc
National Tube Co.

Piston Rod Ejectors.
Watson-Stillman Co.

Planers.
Betts Works of Consolidated Machine Tool Corp of America
Niles Tool Works Co., The
Sellers & Co., Inc., Wm.

Planers, Crank.
Newton Works of Consolidated Machine Tool Corp of America.

Planers, Plate.
Cleveland Punch & Shear Works Co., The.
Hilles & Jones Works of Consolidated Machine Tool Corp. of America.
Niles Tool Works Co., The
Underwood Corp., H. B.
Sellers & Co., Inc., Wm.

Planers, Rotary.
Cleveland Punch & Shear Works Co.
Newton Works of Consolidated Machine Tool Corp of America.
Niles Tool Works Co., The
Underwood Corp., H. B.

Planers, Valve Seat.
Rooksby & Co., E. J.
Underwood Corp., H. B.

Planing Attachments, Radius.
Underwood Corp., H. B.
Cleveland Punch & Shear Works Co., The.

Planning Machines.
Sellers & Co., Wm., The.

Plate and Sheet Metal Work.
Baldwin Locomotive Works, The.

Plates.
Bethlehem Steel Co.
Carnegie Steel Co.
International Nickel Co.
National Malleable & Steel Castings Co.

Plates, Boiler, Firebox, etc.
Carnegie Steel Co.
Bethlehem Steel Co.

Plates, Iron and Steel.
Armco Railroad Sales Co.
Bethlehem Steel Co., Inc.
Carnegie Steel Co.

Plates, Monel Steel.
International Nickel Co.

Plates, Surface.
Brown & Sharpe Mfg. Co.

Plates, Tie.
Bethlehem Steel Co.
National Malleable & Steel Castings Co.

Platforms, Car.
General Steel Castings Co.

Platforms, Cast Steel, Car.
General Steel Castings Co.

Plugs, Fusible.
Lunkenheimer Co.

Plunger Pumps.
Ingersoll-Rand Co.
Worthington Pump & Machinery Co.

Pneumatic Tools.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.

Poles and Posts, Tubular Steel.
National Tube Co.

Portable Tools.
Rooksby & Co., E. J.
Underwood Corp., H. B.

Presses, Arbor.
Chambersburg Engineering Co.
Watson-Stillman Co., The.

Presses, Banding.
Chambersburg Engineering Co.
Watson-Stillman Co., The.

Presses, Bending or Straightening.
Chambersburg Engineering Co.
Cleveland Punch & Shear Works Co.
Watson-Stillman Co.

Presses, Bushing.
Chambersburg Engineering Co.
Niles Tool Works Co., The
Lucas Machine Tool Co.
Watson-Stillman Co., The.

Presses, Crank Pin.
Watson-Stillman Co., The.

Presses, Flanging—Hydraulic
Chambersburg Engineering Co.
Watson-Stillman Co., The.

Presses, Forging.
Chambersburg Engineering Co.
Cleveland Punch & Shear Works Co.
Niles Tool Works Co., The
Watson-Stillman Co., The.

Presses, Hydraulic.
Chambersburg Engineering Co.
Niles Tool Works Co., The
Sellers & Co., Inc., Wm.
Watson-Stillman Co., The.

Presses, Wheel.
Chambersburg Engineering Co.
Niles Tool Works Co., The
Watson-Stillman Co., The.

Pumps, Boiler Feeder.
Worthington Pump & Machinery Corp.

Pumps and Pumping Machinery.
Chambersburg Engineering Co.
Worthington Pump & Machinery Corp.

Pumps, Hydraulic.
Ingersoll-Rand Co.
Watson-Stillman Co., The.
Worthington Pump & Machinery Co.

Pumps, Oil and Lubricant.
Brown & Sharpe Mfg. Co.
Ingersoll-Rand Co.
Worthington Pump & Machinery Corp.

Punching and Shearing Machines.
Chambersburg Engineering Co.
Cleveland Punch & Shear Works.
Hilles & Jones Works of Consolidated Mach. Tool Corp. of America.

Punching Machine, Combined Punch, Shear and Cope.
Hilles & Jones Works of Consolidated Mach. Tool Corp. of America.

Punching Machine, Horizontal.
Hilles & Jones Works of Consolidated Mach. Tool Corp. of America.

Punching Machine, Vertical.
Cleveland Punch & Shear Works Co., The.

Punching Machines, Multiple
Cleveland Punch & Shear Works Co., The.
Hilles & Jones Works of Consolidated Mach. Tool Corp. of America.

Quartering Machine.
Niles Tool Works Co., The

Radial Buffers.
Franklin Ry. Supply Co.

Rail.
Bethlehem Steel Co.
Carnegie Steel Co.

Rail Benders, Portable.
Q. & C. Co., The.

Rail, Guard.
Bethlehem Steel Co.

Rail Saws, Circular (Portable).
Q. & C. Co., The.

Railway Supplies.
Q. & C. Co., The.

Reamers.
Brown & Sharpe Mfg. Co

Refrigerators.
Wine Railway Appliance Co.

Regulators, Acetylene & Oxygen.
Oxweld Railroad Service Co.

Replacers
Q. & C. Co., The.

Respirators.
Willson Products Co.

Reverse Gears, Power.
Barco Mfg. Co.
Franklin Ry. Supply Co.

Rivet Heaters, Electric.
General Electric Co.

Rivet Making Machines.
Acme Machinery Co., The
Ajax Machinery Co.

Rivet Sets.
Cleveland Punch & Shear Works Co., The.
Ingersoll-Rand Co.

Riveters, Hydraulic.
Chambersburg Engineering Co.
Watson-Stillman Co., The

Riveting Hammers.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.

Riveting Machines.
Chambersburg Engineering Co.

Rivets.
Burden Iron Co.

Rods, Monel Metal Nickel.
International Nickel Co.

Rolls, Bending and Straightening.
Cleveland Punch & Shear Works Co., The.
Hills & Jones Works of Consolidated Mach. Tool Corp. of America.
Niles Tool Works Co., The

Rolls, Reclaiming.
Ajax Manufacturing Co.

Roundhouse Blower Line Joints.
Barco Mfg. Co.
Franklin Ry. Supply Co.

Rules—Scales.
Brown & Sharpe Mfg. Co.

Rust Preventive.
Dearborn Chemical Co.
Oakite Products, Inc.

Safe Ends.
National Tube Co.

Sand Aerating Machines.
Sellers & Co., Wm., The.

Sand Rammers.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.

Saws, Portable Pneumatic
Ingersoll-Rand Co.

Saws, Safety
Newton Works of Consolidated Machine Tool Corp. of America.

Screw Machines, Automatic.
Brown & Sharpe Mfg. Co.

Screw Machines, Plain and Hand.
Brown & Sharpe Mfg. Co.

Screw Machines, Wire Feed.
Brown & Sharpe Mfg. Co.

Shafting, Steel Tubing.
National Tube Co.

Shapers
Consolidated Machine Tool Corp. of America.

Shapes, Structural.
Carnegie Steel Co.

Shearing Machines, Angle.
Cleveland Punch & Shear Works Co., The.
Hilles & Jones Works of Consolidated Mach. Tool Corp. of America.

Shearing Machines, Bar Iron.
Chambersburg Engineering Co.
Cleveland Punch & Shear Works Co., The.
Hilles & Jones Works of Consolidated Mach. Tool Corp. of America.

Shearing Machines, Bevel.
Cleveland Punch & Shear Works Co., The.
Hilles & Jones Works of Consolidated Mach. Tool Corp. of America.

Shearing Machine, Gate.
Cleveland Punch & Shear Works Co., The.
Hilles & Jones Works of Consolidated Mach. Tool Corp. of America.

Shearing Machines, Plate.
Cleveland Punch & Shear Works Co., The.

Shears, Plate, Sheet-Metal Rotary.
Hilles & Jones Works of Consolidated Mach. Tool Corp. of America.

Sheets, Annealed, Black, Car Roofing and Siding Galvanized, Iron and Steel Locomotive Jacket, Polished or Planished Iron.
Armco Railroad Sales Co.

Sheets, Monel Metal Nickel
International Nickel Co.

Sheets, Steel.
Armco Railroad Sales Co.
Bethlehem Steel Co.

Signal Pipe, Wrought Steel
National Tube Co.

Skid Shoes, Rail
Q. & C. Co., The.

Slag, Blast Furnace.
Carnegie Steel Co.

Slotting Machinery, Frame
Betts Machine Co.
Niles Tool Works Co., The
Sellers & Co., Inc., Wm.

Slotting Machines.
Betts Works of Consolidated Machine Tool Corp. of America.
Newton Works of Consolidated Machine Tool Corp. of America.
Niles Tool Works Co., The
Sellers & Co., Inc., Wm.

Small Tools.
Cleveland Punch & Shear Works Co., The.

Snow Melting Device.
Q. & C. Co., The.

Snow Plows.
Q. & C. Co., The.

Soldering Irons, Acetylene.
Oxweld Railroad Service Co.

Spark Arresters.
Locomotive Firebox Co.

Special Machinery.
Betts Works of Consolidated Machine Tool Corp. of America.
Lucas Machine Tool Co.
Newton Works of Consolidated Machine Tool Corp. of America.
Niles Tool Works Co., The
Underwood Corp., H. B.

Splice Bars, Angle.
Bethlehem Steel Co.
Carnegie Steel Co.

Spring Plates and Seats
National Malleable & Steel Castings Co.

Spring Shop Machinery
Watson-Stillman Co.

Springs.
Baldwin Locomotive Works, The.

Squares, Combination.
Brown & Sharpe Mfg. Co.

Staybolt and Bolt Turning Threading Machines.
Consolidated Machine Tool Corp. of America.

Staybolt Bars.
Bethlehem Steel Co., Inc.
Burden Iron Co.

Staybolt Drivers.
Independent Pneumatic Tool Co.
Ingersoll-Rand Co.

Staybolt, Steel.
Bethlehem Steel Co., Inc.
Burden Iron Co.

Staybolt Taps.
Flannery Bolt Co.

Staybolt Testers, Flexible (Elect. Contact).
Flannery Bolt Co.

Staybolts
American Locomotive Co.
Bethlehem Steel Co.
Flannery Bolt Co.

Stay Tubes.
National Tube Co.

Steam Chests.
Franklin Ry. Supply Co.

Steel, Alloy
Bethlehem Steel Co.
Carnegie Steel Co.
Central Alloy Steel Co., The
S. K. F. Industries.
Timken Roller Bearing Co.

Steel, Carbon.
Bethlehem Steel Co., Inc.
Carnegie Steel Co.
S. K. F. Industries.
Timken Roller Bearing Co.

Steel, Die.
Bethlehem Steel Co., Inc.
S. K. F. Industries.
Timken Roller Bearing Co.

Steel Firebox.
Bethlehem Steel Co.
Carnegie Steel Co.

Steel, Heat Treated.
Bethlehem Steel Co.

Steel, High Speed Tool.
Timken Roller Bearing Co.

Steel, Hot Work Tool.
Bethlehem Steel Co., Inc.

Steel, Structural.
Bethlehem Steel Co.
Carnegie Steel Co.

Steel Sheets.
Armco Railroad Sales Co.
Bethlehem Steel Co., Inc.
Central Alloy Steel Corp.

Steel, Tool.
Bethlehem Steel Co., Inc.
S. K. F. Industries.

Stop-Cocks (Lubricating)
Dart Mfg. Co.

Strip, Hot or Cold Rolled.
Armco Railroad Sales Co.

Stud Setters, Self-Opening
Geometric Tool Co.
Modern Tool Works of the Consolidated Mach. Tool Corp. of America.

Superheater Pipes.
National Tube Co.

Surface Plates.
Brown & Sharpe Mfg. Co.

Syphons, Locomotive
Locomotive Firebox Co.

Tables, Welding.
Oxweld Railroad Service Co.

Tank Work.
Baldwin Locomotive Works, The.

Tanks, Acetylene.
Oxweld Railroad Service Co.

Tapping Machines and Attachments.
Acme Machinery Co., The
Geometric Tool Co., The.

Taps, Collapsing.
Geometric Tool Co., The
Modern Tool Works of the Consolidated Mach. Tool Corp. of America.

Testers, Boiler.
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Wheels, Steel.
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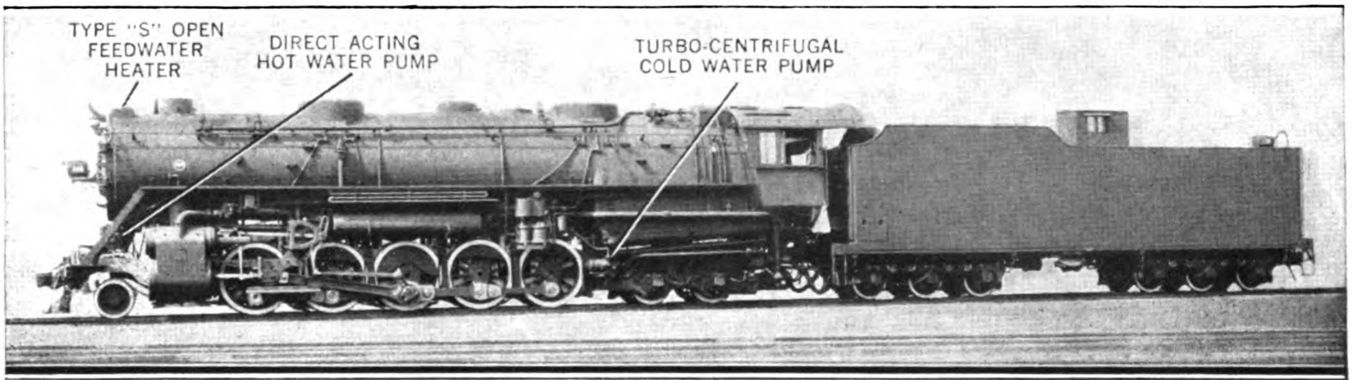

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